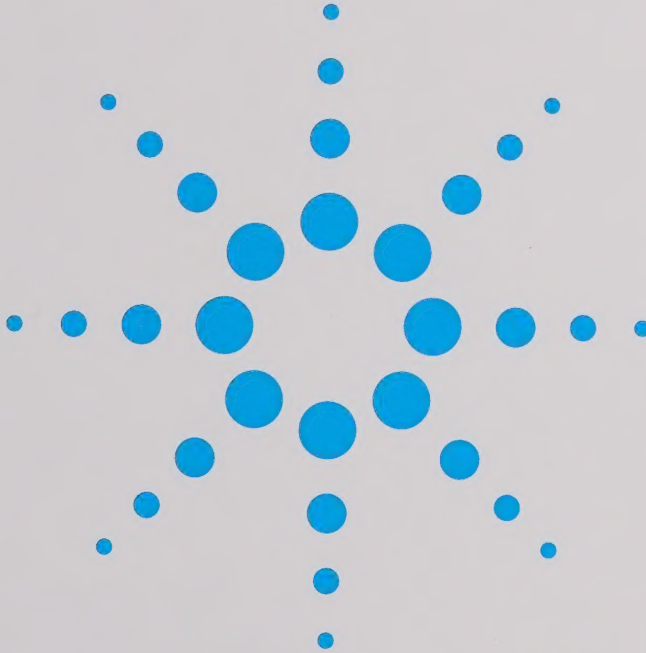


Agilent J2126/7A
Transmission Test Sets
**Installation and Verification
Manual**

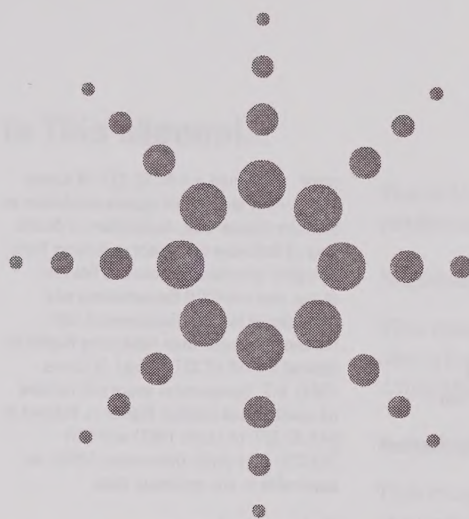


Agilent Technologies



Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_09053



Agilent J2126/7A

Transmission Test Set

Installation and Verification Manual



Agilent Technologies

Notices

© 2001 Agilent Technologies UK Limited

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies UK Limited as governed by international copyright laws.

Sales and Service Offices

An up-to-date list of Agilent Offices is available through the Agilent Website at URL:

<http://www.agilent.com>

Manual Part Number

J12127-90002

Edition

First edition, September 2001

Printed in UK

Agilent Technologies UK Limited
Telecommunications Networks Test
Division
South Queensferry, West Lothian, Scotland
EH30 9TG

Warranty

The material contained in this document is provided "as is," and is subject to being changed without notice in future editions. Further, to the maximum extent permitted by applicable law, Agilent Technologies disclaims all warranties of merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any of the products to which it pertains. Should Agilent Technologies have a written contract with the user and should any of the contract terms conflict with these terms the contract terms shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer soft-

ware" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

In This Manual...

You will find information for installing and verifying the performance of your Transmission Test Set

1 Introduction

This chapter provides a brief description of the product and also all safety requirements the user should be aware of when using the Transmission Test Set.

2 Installation

This chapter provides general information on how to install and connect up the Transmission Test Set.

3 Performance Tests

This chapter details the procedures to test the performance of the Transmission Test Set and provides a test record table to record the results of the tests.

4 Self Test Overview

This chapter details all of the Self Test procedures.

5 ETSI/ANSI Terminology

This chapter provides a table explaining the equivalent SDH/SONET terms.

Conventions Used in this Manual

The conventions used in this manual to illustrate instrument keys and display information are as follows:

<Menu> This is an example of a hardkey. Hardkeys (located to the right of the display) are used to give access to different sets of instrument settings, or select dedicated instrument functions.

Menu Items Menu items appear in text in **bold** with the greater than (>) symbol separating each menu level. For example, if you are instructed to choose Errors and Alarms from the Test Functions menu, it appears as **Test Functions>Errors and Alarms**.

Field Items Field items you can select will appear in **bold**, for example select **Signal Rate** field.

Drop Down Lists The item you must select from a drop down list is also shown in bold. For example, select **Signal Rate** field and choose **STM-1** or **OC-3** from the drop down list.

Contents

1 Introduction

Product Description	10
Option Guide	12
Mainframe test rate capability	12
Optical Interfaces	12
Other Options	13
Enhanced Testing Upgrade - J2129A	13
Accessories	14
General Information	15
Warranty	15
Responsibilities of the Customer	17
Storage and Shipment	19
Safety Precautions for the Operator	21
Safety Symbols	22
Operator Maintenance	23
Cleaning Optical Connectors	23
Statement of Compliance	25
Electromagnetic Compatibility	26
Declaration of Conformity	26

2 Installation

Preparation	28
Initial Inspection	28
Operating Environment	28
Preparation for Use	29
Operation Checks on Delivery	33
Connecting to the Network	40
Laser Warning Symbols	41

Avoiding Optical Receiver Overload	42
Additional Precautions for Service Engineers	43
Safety Precautions	43
ESD Precautions	43
Connectors	44
Top Panel Connectors	44
Optical Out Ports	44
Optical In Ports	45
Clock Ports	46
DCC Port	47
Electrical Test Ports	48
Connectors on Instrument Front/Left Side Panel	50
Connectors on Instrument Front/Right Side Panel	51
Front Panel Soft Recovery (Cold Start)	53
Performing a Cold Start	53
3 Performance Tests	
Introduction	56
Recommended Test Equipment	57
Self Test Loopback Cables and Accessories	58
Recall Default Settings	59
Performance Self Test	60
Description of the Performance Self Test	60
Loopback connections required for Self Test	61
How to run the Self Test	64
What to do if the Self Test fails	64
Internal Reference Clock Accuracy	65
Alternative DS1 Clock test (if suitable DS _n Test Set is not available)	70
External Clock Reference Inputs & Clock Reference Output	71
Optical Pulse Mask and Output Characteristics	78
52/155 & 622 Mb/s Optical Output Checks	79
2.5 Gb/s Optical Output Checks	84

	10 Gb/s Optical Output Checks (J2127A Models only)	86
	Optical Receiver Sensitivity, Optical Power & Frequency Measurement	89
	Performance Test Record	106
4	Self Test Overview	
	Description of the Self Test	112
	List of Self Tests	113
	Loopback connections required for Self Test	114
	How to run a Self Test	117
	What to do if the Self Test Fails	121
5	ETSI/ANSI Terminology	
	ETSI/ANSI Conversion and Equivalent Terms	124

1. Introduction 1

2. Safety 2

3. Installation 3

4. Operation 4

5. Maintenance 5

6. Troubleshooting 6

7. Appendix 7

8. Glossary 8

9. Index 9

10. Declaration 10

11. Warranty 11

12. Contact Information 12

13. Revision History 13

14. Environmental Information 14

15. Legal Information 15

16. Notes 16

17. Figures 17

18. Tables 18

19. Diagrams 19

20. Photographs 20

21. Videos 21

22. Audio 22

23. Software 23

24. Hardware 24

25. Accessories 25

26. Tools 26

27. Materials 27

28. Components 28

29. Subsystems 29

30. Systems 30

31. Networks 31

32. Databases 32

33. Applications 33

34. Services 34

35. Products 35

36. Companies 36

37. Organizations 37

38. Associations 38

39. Committees 39

40. Groups 40

41. Individuals 41

42. Locations 42

43. Dates 43

44. Times 44

45. Units 45

46. Symbols 46

47. Abbreviations 47

48. Acronyms 48

49. Initials 49

50. Suffixes 50

51. Prefixes 51

52. Suffixes 52

53. Prefixes 53

54. Suffixes 54

55. Prefixes 55

56. Suffixes 56

57. Prefixes 57

58. Suffixes 58

59. Prefixes 59

60. Suffixes 60

61. Prefixes 61

62. Suffixes 62

63. Prefixes 63

64. Suffixes 64

65. Prefixes 65

66. Suffixes 66

67. Prefixes 67

68. Suffixes 68

69. Prefixes 69

70. Suffixes 70

71. Prefixes 71

72. Suffixes 72

73. Prefixes 73

74. Suffixes 74

75. Prefixes 75

76. Suffixes 76

77. Prefixes 77

78. Suffixes 78

79. Prefixes 79

80. Suffixes 80

81. Prefixes 81

82. Suffixes 82

83. Prefixes 83

84. Suffixes 84

85. Prefixes 85

86. Suffixes 86

87. Prefixes 87

88. Suffixes 88

89. Prefixes 89

90. Suffixes 90

91. Prefixes 91

92. Suffixes 92

93. Prefixes 93

94. Suffixes 94

95. Prefixes 95

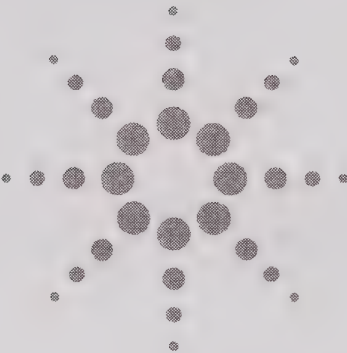
96. Suffixes 96

97. Prefixes 97

98. Suffixes 98

99. Prefixes 99

100. Suffixes 100



1 Introduction

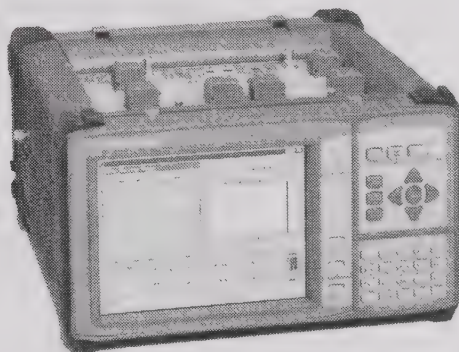
Product Description	10
General Information	15
Safety Precautions for the Operator	21
Operator Maintenance	23
Statement of Compliance	25

This chapter provides a brief description of the product and also all safety requirements the user should be aware of when using the Transmission Test Set.



Product Description

The Agilent Transmission Test Set provides all the test capability you need to install and verify the performance of today's high-capacity transmission systems and networks in one portable package.



- Global test coverage (SONET and SDH).
- Full integrated all-rate testing:
 - 52 Mb/s to 10 Gb/s optical.
 - 52/155 Mb/s; DS1/3; 2/8/34/140 Mb/s electrical.
- Full range of standard and concatenated mappings.
- All standard error and alarm measurements, plus:
 - optical power, electrical level, pulse mask, frequency.
 - service disruption time, pointer movements, delay.
- Simultaneous all-channel testing (up to 192 STS's/AU's).
- Thru-mode monitoring support.
- Comprehensive SDH/SONET overhead testing.
- Fast access to key measurement tasks via Smart Test.
- Line frequency offset.
- Transmit and Receive can be independently configured.
- Broad range of graphical results tools.

- Comprehensive on-line help facilities:
 - On-line User manual.
 - Context-sensitive help for each control field
 - Ability to add 'your own help documents'.

Option Guide

This guide explains the features offered with each Transmission Test Set mainframe and its associated options. There are two mainframes as follows:

- J2126A - for optical interfaces up to 2.5 Gb/s
- J2127A - for optical interfaces up to 10 Gb/s

Mainframe test rate capability

Mainframe	Optical Test Interfaces
J2126A	OC-1, OC-3, OC-12, OC-48 STM-0, STM-1, STM-4, STM-16
J2127A	OC-1, OC-3, OC-12, OC-48, OC-192 STM-0, STM-1, STM-4, STM-16, STM-64

Optical Interfaces

	Wavelength	Option
Select one wavelength option for optical interfaces up to 2.5 Gb/s	1310 nm optical transmitter	100
	1550 nm optical transmitter	101
	1310/1550 nm optical transmitter	102
Optical Interfaces operating at 10 Gb/s	1550 nm optical transmitter	111

Optical Connectors

Connector	Option
FC/PC Adapters fitted on all optical interfaces	190
SC Adapters fitted on all optical interfaces	191
ST Adapters fitted on all optical interfaces	192

Other Options

Certificate of Calibration

Option UK6: Calibration certificate with test data

Warranty and Service Plans

Option W30: Warranty extended to 3 years

Option W50: Warranty extended to 5 years

Enhanced Testing Upgrade - J2129A

Firmware upgrade product that adds the following test facilities:

- Electrical interfaces (DS1/3; 2/8/34/140 Mb/s; 52/155 Mb/s)
- VT/TU payload testing
- DS1/3 and 2/34/140 Mb/s service mappings
- DSn and PDH (En) testing
- Pulse mask testing (up to 52 Mb/s electrical)
- Service disruption measurement
- Round trip delay measurement
- Electrical level measurement
- Graphical error and alarm result displays
- G.821, M2100, M2101, M2101.1, M2110, M.2120 performance analysis

Accessories

Additional Documentation

J7280A: Full set of printed manuals:

User's Guide, Quick Reference Guide, Remote Control and Installation and Verification manuals.

Carrying Cases

J7286A: Hard transit case (for J2126A)

J7287A: Hard transit case (for J2127A)

J7288A: Soft carrying case (for J2126/7A)

Optical Adapters and Cables

J7283A: FC/PC optical connector (exchangeable)

J7284A: SC optical connector (exchangeable)

J7285A: ST optical connector (exchangeable)

J7281A: DCC port converter cable: 9-pin miniature D-type to 37-pin D-type (RS-449, female)

General Information

Warranty

Agilent Technologies UK Limited	
Product	Duration of Warranty
Transmission Test Set Agilent J2126/7A	1 Year

- 1 Agilent warrants Agilent hardware, accessories and supplies against defects in materials and workmanship for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.
- 2 Agilent warrants that Agilent software will not fail to execute its programming instructions, for the period specified above, due to defects in material and workmanship when properly installed and used. If Agilent receives notice of such defects during the warranty period, Agilent will replace software media which does not execute its programming instructions due to such defects.
- 3 Agilent does not warrant that the operation of Agilent products will be uninterrupted or error free. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, customer will be entitled to a refund of the purchase price upon prompt return of the product.
- 4 Agilent products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.
- 5 The warranty period begins on the date of delivery or on the date of installation if installed by Agilent. If customer schedules or delays Agilent installation more than 30 days after delivery, warranty begins on the 31st day from delivery.

- 6** Warranty does not apply to defects resulting from (a) improper or inadequate maintenance or calibration, (b) software, interfacing, parts or supplies not supplied by Agilent, (c) unauthorized modification or misuse, (d) operation outside of the published environmental specifications for the product, or (e) improper site preparation or maintenance.
- 7** TO THE EXTENT ALLOWED BY LOCAL LAW, THE ABOVE WARRANTIES ARE EXCLUSIVE AND NO OTHER WARRANTY OR CONDITION, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED AND AGILENT SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, SATISFACTORY QUALITY, AND FITNESS FOR A PARTICULAR PURPOSE.
- 8** Agilent will be liable for damage to tangible property per incident up to the greater of \$300,000 or the actual amount paid for the product that is the subject of the claim, and for damages for bodily injury or death, to the extent that all such damages are determined by a court of competent jurisdiction to have been directly caused by a defective Agilent product.
- 9** TO THE EXTENT ALLOWED BY LOCAL LAW, THE REMEDIES IN THIS WARRANTY STATEMENT ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. EXCEPT AS INDICATED ABOVE, IN NO EVENT WILL AGILENT OR ITS SUPPLIERS BE LIABLE FOR LOSS OF DATA OR FOR DIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFIT OR DATA), OR OTHER DAMAGE, WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE.

FOR CONSUMER TRANSACTIONS IN AUSTRALIA AND NEW ZEALAND: THE WARRANTY TERMS CONTAINED IN THIS STATEMENT, EXCEPT TO THE EXTENT LAWFULLY PERMITTED, DO NOT EXCLUDE, RESTRICT OR MODIFY AND ARE IN ADDITION TO THE MANDATORY STATUTORY RIGHTS APPLICABLE TO THE SALE OF THIS PRODUCT TO YOU.

Responsibilities of the Customer

The customer shall provide:

- 1 Access to the products during the specified periods of coverage to perform maintenance.
- 2 Adequate working space around the products for servicing by Agilent personnel.
- 3 Access to and use of all information and facilities determined necessary by Agilent to service and/or maintain the products. (Insofar as these items may contain proprietary or classified information, the customer shall assume full responsibility for safeguarding and protection from wrongful use.
- 4 Routine operator maintenance and cleaning as specified in the Agilent Operating and Service Manuals.
- 5 Consumables such as paper, disks, magnetic tapes, ribbons, inks, pens, gases, solvents, columns, syringes, lamps, septa, needles, filters, frits, fuses, seals, detector flow cell windows, etc.

Certification

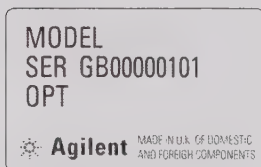
Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility and to the calibration facilities of other International Standards Organization members.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent products.

Instruments Covered By Manual

Attached to the **bottom panel** of the instrument is a serial number plate. The serial number plate has a two letter reference denoting country of origin (GB = Great Britain) and an eight digit serial number. The serial number is unique to each instrument and should be quoted in all correspondence with Agilent, especially when ordering replacement parts.



Serial Number Plate

Storage and Shipment

The instrument may be stored or shipped in environments within the following limits:

Temperature

-20°C to +70°C

Altitude

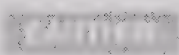
Up to 4,600 meters (15,000 feet)

The instrument should also be protected from temperature extremes which could cause condensation within the instrument.

Repackaging for Shipment

Shipping to Service Centers. You can re-use the packaging, if in its original condition, for onwards transportation and to return the instrument for calibration or servicing. If the instrument is being returned to Agilent for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. In any correspondence, refer to the instrument by model number and full serial number.

Shipping/Transit to Customer Sites Soft and hard transit cases are available as an optional accessory. (Order item no. J7286A: Hard transit case for J2126A, J7287A: Hard transit case for J2127A, J7288A: Soft carrying case for J2126/7A). It is recommended that these are used for shipping to your customer sites. The soft case should only be used if the instrument is being hand carried as it offers only light protection. The hard case should always be used when transporting the instrument in an aircraft hold.



The instrument cover should always be fitted when transporting the instrument.

Other Packaging. The following general instructions should be followed when repackaging with commercially available materials:

- Wrap instrument in heavy paper or plastic. If the instrument is being shipped to Agilent, attach a tag indicating the type of service required, return address, model number and full serial number.
- Use a strong shipping container. A double wall carton made of 350 pound test material is adequate.
- Use a layer of shock absorbing material 70 to 100 mm (3 to 4 inch) thick, around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect the Front Panel controls and Top Panel connectors with cardboard.
- Seal shipping container securely.
- Mark shipping container FRAGILE to ensure careful handling.
- In any correspondence, refer to instrument by model number and full serial number.

Weight and Dimensions

Weight	
• J2126A	8.7 kg (19lb) (covers all rates to 2.5 Gb/s)
• J2127A	11.2 kg (25 lb) (covers all rates to 10 Gb/s)

Dimensions	
• J2126A	180 mm x 331 mm x 224 mm (7.1 in x 13 in x 8.8 in)
• J2127A	180 mm x 331 mm x 288 mm (7.1 in x 13 in x 11.3 in)

Safety Precautions for the Operator

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

In particular, the operator should note the following safety information:

- “Safety Symbols” on page 22.
- “Connecting to the Power Supply” on page 30.
- “Operating Environment” on page 28.
- “Operator Maintenance” on page 23.

WARNING

DO NOT operate damaged equipment. Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Agilent Sales and Service Office for service and repair to ensure the safety features are maintained.

Safety Symbols

The following symbols on the instrument and in the manual indicate precautions which must be taken to maintain safe operation of the instrument.



The Instruction Documentation Symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the supplied documentation.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment - protects against electrical shock in case of fault.



Frame or chassis ground terminal - typically connects to the equipment's metal frame.



Alternating current (AC).



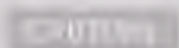
Direct current (DC).



Indicates hazardous voltages.



Warning denotes a hazard. It calls attention to a procedure, which if not correctly performed or adhered to could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.



Caution denotes a hazard. It calls attention to a procedure, which if not correctly performed or adhered to could result in damage to or destruction of the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.



Indicates that a laser is fitted. The user must refer to the manual for specific Warning or Caution information to avoid personal injury or damage to the product.

Operator Maintenance

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.

Maintenance appropriate for the operator is:

- Cabinet cleaning
- Optical Connector Cleaning
- Ensure ventilating fan cover is clean.

Cleaning Optical Connectors

We recommend cleaning the optical connectors at regular intervals using the following materials:

Description	Agilent Part Number
Compressed Air Can or Blow Brush	
Isopropyl Alcohol	8500-5344
Lens Cleaning Paper	9300-0761
Swabs	5080-5400

CAUTION

Do not insert any tool or object into the optical IN or OUT ports of the instrument as damage to or contamination of the optical fibre may result.

- 1 Disconnect the instrument from the Power Line or switch off the laser transmitter before commencing this cleaning procedure.
- 2 Remove the adapters from the optical IN and OUT ports by flipping back the lever on the optical adapter.
- 3 Using the blow brush with the brush removed blow through the ferrule of the standard flexible connector and the adapter.

- 4** If the optical fibre of the fixed connector requires further cleaning this entails disassembly of the module. This should be carried out only by suitably trained service personnel.
- 5** Apply some isopropyl alcohol to a piece of the cleaning paper and clean the barrel of the adapter. Using a new piece of cleaning paper, clean the face of the adapter. Repeat this operation, using a new piece of cleaning paper each time.
- 6** Use a blow brush or compressed air to remove any particles of cleaning paper which may be present.
- 7** Replace the adapters in the optical connector. Secure in place by clicking the retaining lever back into position.

Statement of Compliance

This instrument has been designed and tested in accordance with IEC Publication 61010-1 (1990) + A1:1992 + A2(1995) Safety requirements for Electrical Equipment for Measurement, Control and Laboratory Use, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.



The CE mark shows that the product complies with all relevant European legal Directives.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

ICES/NMB-001

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.



The CSA mark is a registered trademark of the Canadian Standards Association.



Australian EMC Regulations

The C-Tick mark is a registered trademark of the Australian Communications Authority. This signifies compliance with the Australian EMC Framework Regulations under the terms of the Radiocommunications Act of 1992.

Noise Declaration (German)

LpA<70dB

am Arbeitsplatz (operator position)

normaler Betrieb (normal position)

nach DIN 45635 pt.19 (per ISO 7779)

Electromagnetic Compatibility

This product conforms with the protection requirements of European Council Directive 89/336/EEC for Electromagnetic Compatibility (EMC).

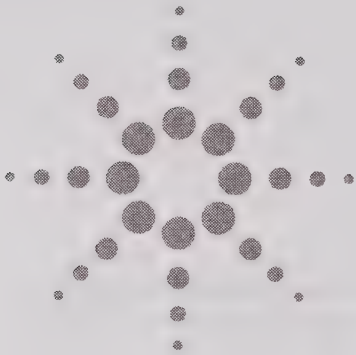
The conformity assessment requirements have been met using the technical Construction file route to compliance, using EMC test specifications EN 55011:1991 (Group 1, Class A) and EN 50082-1:1992.

In order to preserve the EMC performance of the product, any cable which becomes worn or damaged must be replaced with the same type and specification.

See also "10 Base-T Lan Connection Radiated Emissions" on page 43.

Declaration of Conformity

A Declaration of Conformity is provided on the CD-ROM shipped with your instrument.



2 Installation

Preparation	28
Operation Checks on Delivery	33
Connecting to the Network	40
Connectors	44
Front Panel Soft Recovery (Cold Start)	53

This chapter provides general information on how to install and connect up the Transmission Test Set.



Preparation

Initial Inspection

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure.

Inspect the shipping container for damage.

If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.

Procedures for checking operation on delivery are given later in this chapter on page 33.

If the contents of the shipment are incomplete, if there is mechanical damage or defect, notify the nearest Agilent Office.

If the instrument does not pass the delivery checks given on page 33, notify the nearest Agilent office.

If the shipping container is also damaged, or the cushioning material shows signs of stress, notify the carrier as well as the nearest Agilent office. Keep the shipping materials for the carrier's inspection. The Agilent office will arrange for repair or replacement without waiting for claim settlement.

Operating Environment

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gasses or fumes.

This instrument may be operated in environments within the following limits:

Temperature: 0°C to +50°C.

Altitude: Up to 3050 m (10,000 ft).

Humidity: Up to 90% relative humidity to 40°C, but it should be protected from temperature extremes which may cause condensation.

To ensure adequate cooling, do not obstruct air vents in the instrument cabinet.

This instrument is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1 and IEC 60664 respectively.

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

This product is suitable for indoor use only.

Preparation for Use

WARNING

If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must be used in a normal condition only (in which all means for protection are intact).

Power Requirements

The Transmission Test Set requires a power source of 100 to 240 V ac at a frequency between 47 and 63 Hz (nominal).

Power consumption:

J2126A: 150 VA, J2127A: 250VA

There are no customer replaceable fuses in the Transmission Test Set.

Connecting to the Power Supply

WARNING

This is a Safety Class I instrument (provided with a protective earthing ground, incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

The mains switch fitted to the instrument is a single pole device and must not be used as the disconnect device. The IEC320 coupler is intended as the main disconnect device. The switch is marked I and O. The I indicates on and the O indicates off. Do not position the instrument such that access to the coupler is impaired.

Before switching on this instrument, make sure that the line supply voltage is in the specified ranges. Range selection is automatic.

Power Cable

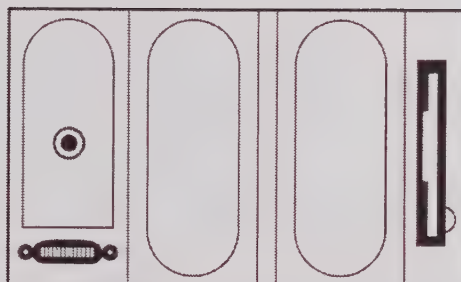
WARNING

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on:

(a) While this is a Class I product, provided with a protective earthing conductor in a power cord, an external protective earthing terminal has also been provided. This terminal is for use where the earthing cannot be assured. At least an 18AWG earthing conductor should be used in such an instance, to ground the instrument to an assured earth terminal. The external protective earth terminal is on the front/left side of the instrument as shown in Figure on page 31.

(b) If this instrument is to be energized via an auto-transformer to reduce or increase the line voltage, make sure that the common terminal is connected to the neutral pole of the power source.

(c) The power cable plug shall only be inserted into a socket outlet provided with a protective ground contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).



Earthing terminal - left side panel

The power cord supplied with each instrument varies with the country of destination. The following figure illustrates the standard power plug and cord configurations that are commonly used. The part number shown beneath each plug is the part number of the appropriate power cord and plug. If the appropriate power cord is not included with the instrument notify the nearest Agilent office and a replacement will be provided.

8120-2*04	8120-1369	8120-1689	8120-1351	8120-1378 US 8120-4753 JAP	8120-2956	8120-4211

Power cable configurations and part numbers

Removing the Instrument Cover

To remove the instrument cover release both clips on the top of the cover and lift off. When transporting the instrument, always replace this cover to protect the instrument connectors and display.

Useful information when requesting support

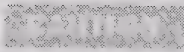
When contacting Agilent Technologies for support it is useful to have the following instrument information available.

- Model Number.
- Serial Number. (on instrument base plate in the format GBXXXXXXXXXX)
- Instrument Options. (These can be located on the instrument by pressing <Menu> and selecting **System >Options.**)
- Instrument Firmware Revision. (This can be located on the instrument by pressing <Menu> and selecting **System >Preferences**)
- Self Test fail codes and messages. (These can be located on the instrument by pressing <Menu> and selecting **System >Self Test**)

Operation Checks on Delivery

The Procedure that follows gives a quick Power-up check and Back to Back functional test of the Optical interfaces using the Optical accessories provided.

These checks should be performed by the user or engineer familiar with making Optical interface connections.



Safety precautions care and connection cleanliness must be observed to ensure that the optical connections are not damaged or degraded. Ensure the recommended optical attenuation is present in all optical loopback connections as failure to do so could cause test failure or damage to the optical receivers

Power-up Sequence

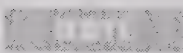
- 1 Connect the Transmission Test Set to the AC Power Line using the Power Cord provided.
- 2 Set Transmission Test Set power switch ON (located beside power inlet).
- 3 Fans should start and after a few seconds the display will initialize and indicate the following.

Initialising Instrument

Please wait.....

The Agilent Technologies splash screen will then be displayed while the unit completes initialization.

- 4 On completion (approximately 30 Secs) the display will change to the user windows with instrument settings.
- 5 Instrument is now ready for use.

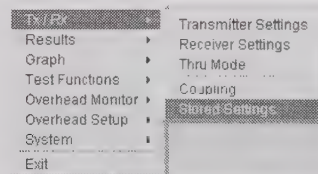


Online help and Context Sensitive Help is available on the instrument. If you require assistance at any time press the **<Help>** button on the front panel. This will display the online help. While running the instrument a single line of text appears at the bottom of the display. This gives you helpful information relating to the area of the screen that is highlighted.

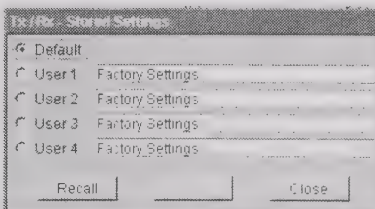
Recalling Default Settings.

To ensure instrument is set to a known state.

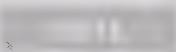
- 1 Press the **<Menu>** key then using the arrow keys select **Tx/Rx > Stored Settings**.



- 2 Select **Default** then Recall.



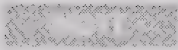
- 3 Select **OK** then wait for a few seconds for instrument to reconfigure to the default settings. Recall has completed when the dialog box clears.
- 4 Select **Close** on the Tx/Rx - Stored Settings window.



The Transmission Test Set is a dual standard SONET/SDH instrument. It should have been set to the Network Standard for the country it was shipped to, however if you need to change this press the **<Menu>** key and select **System > Preferences**. Press **<Select>** to open the Preferences window. Select SONET or SDH as required.

- 5 Proceed with Back to Back functional checks.

Back to Back Functional checks



The supplied Optical Patch Cord and 15 dB Optical Attenuator assembly are used to make an optical connection between the Transmit and Receive Ports for these checks.

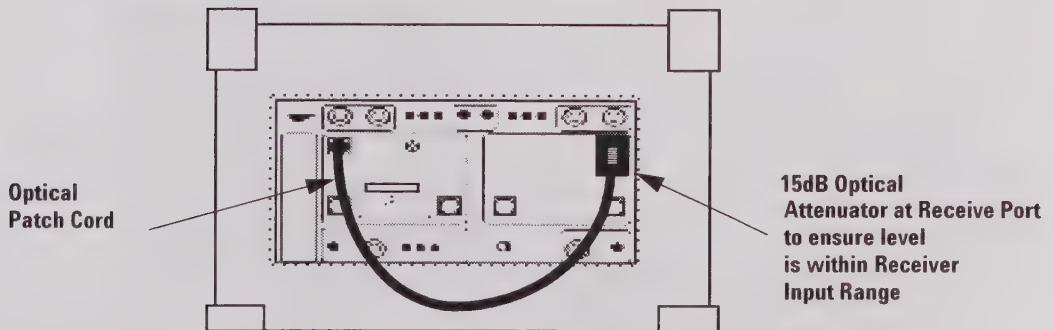
Remove any dust protectors from the ends of Patch Cord and Attenuator before fitting and make sure the (white) exposed ends are not touched by fingers or otherwise become contaminated.

When making connections ensure full location in port key/notch then tighten/lock by hand depending on the connector type.

Always ensure Optical Output Laser LEDs beside ports are OFF while making/changing optical connections.

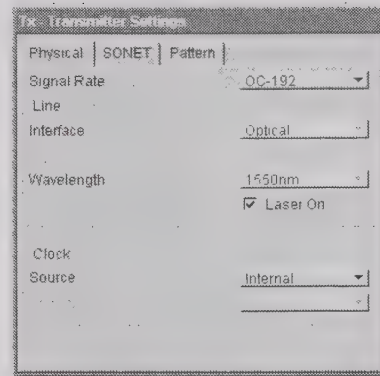
- 1 For J2127A models (up to 10 Gb/s) make connection as follows. If unit is a J2126A model (up to 2.5 Gb/s) skip this step and proceed from step 8.

10 Gb/s Loopback Connections (J2127A Only)



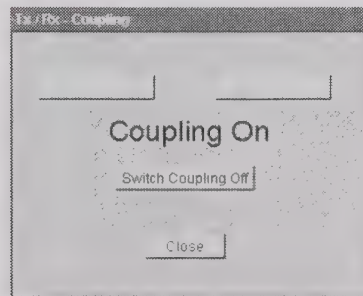
- 2 Press **<Menu>** key then select **Tx/Rx > Transmitter** then use the **<Arrow>** and **<Select>** keys to set **Laser ON**. Displayed Transmitter Settings should be similar to example below.

Note Signal rate may show either (OC-192 or STM-64) depending on instrument System preferences.

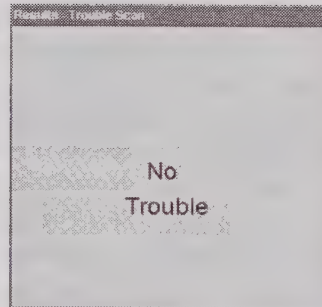


Check the laser LED is illuminated at the 10 Gb/s Output Port on the Transmission Test Set's connector panel.

- 3 Press <Menu> then select **Tx/Rx > Coupling** and select **Copy Tx to Rx** to set Coupling On. Select **Close** to close dialog.

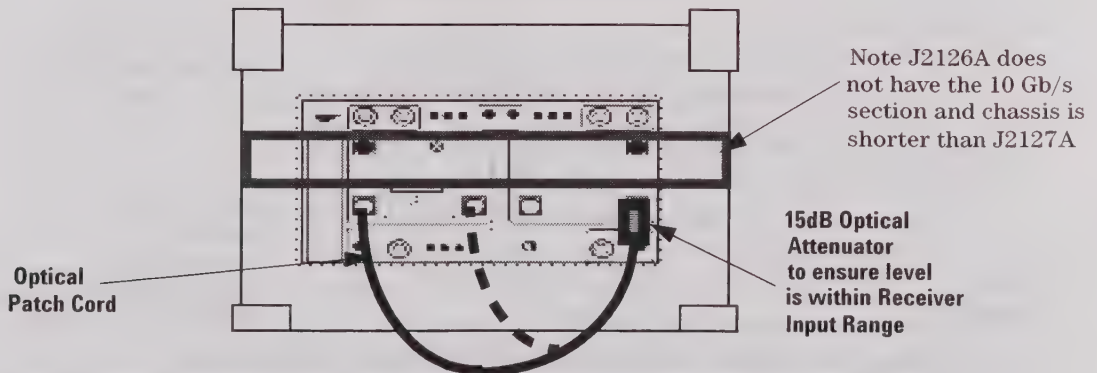


- 4 Press <Smart Test>, select **Shortcuts > Troublescan** then press **Run/Stop** to begin a measurement.
- 5 Check that '**No Trouble**' is displayed in the **Results** window to confirm no errors have been detected. If not then refer to "What to do if the Test fails" on page 39.



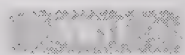
- 6 Press <**Single Error**> button and check that the Errors Led flashes red and some errors accumulate on the **Results - Trouble Scan** window. Then press the <**Run/Stop**> key to stop gating.
- 7 Press <**Window**> key to highlight the Tx-Transmitter Settings window and set the **Laser** to **OFF**.
- 8 Change/Make the following Optical loopback connection to check of the 2.5 Gb/s interface.

2.5 Gb/s Loopback Connections (J2127A shown)



Note - Either of the [52Mb/s - 2.5Gb/s] Transmitter Outputs may be used if both 1310 & 1550nm ports are fitted.

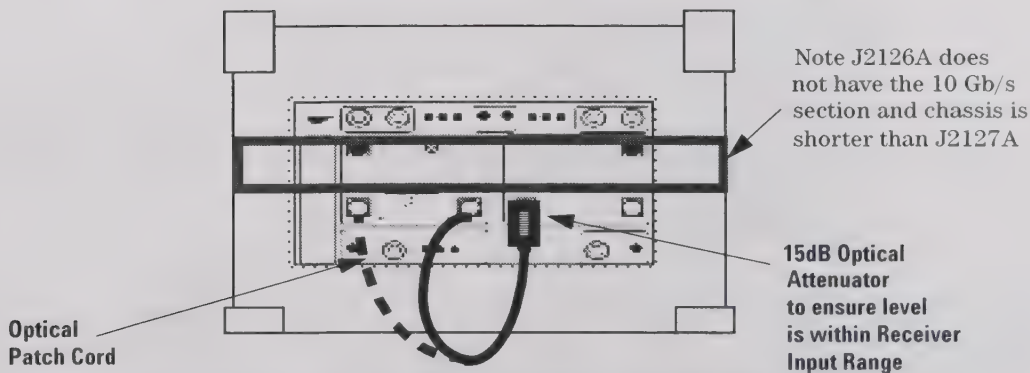
- 9 Change the Transmitter Settings **Signal Rate** to (**OC-48 or STM-16**), and set the **Wavelength** to the be same as the Transmit Port connected in set-up, i.e. **1310nm or 1550nm**.



The Receiver will automatically set to the same Signal Rate if the Transmitter as Tx > Rx Coupling is On. The graphical display on lower window indicates the overall set-up of Transmitter & Receiver. Coupling status is shown in left lower corner.

- 10 Set the **Laser** to **ON** and check the laser LED is illuminated at the connected 52Mb/s-2.5Gb/s Output Port on the Transmission Test Set's connector panel.
- 11 Repeat steps 4 to 6 to confirm correct operation.
- 12 Press <Window> key to highlight the **Tx-Transmitter Settings** page and set the **Laser** to **OFF**.
- 13 Change the Optical loopback connection for check of the 622 Mb/s and below interface.

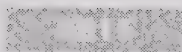
622 Mb/s Loopback Connections (J2127A shown)



Note - Either of the [52Mb/s - 2.5Gb/s] Transmitter Outputs may be used if both 1310 & 1550nm ports are fitted.

- 14 Change the Transmitter Settings **Signal Rate** to (OC-12 or STM-4). and set the Wavelength to the be same as the Transmit Port connected in set-up.
- 15 Set the **Laser to ON** and check the laser LED is illuminated at the connected 52Mb/s-2.5Gb/s Output Port on the Transmission Test Set's connector panel.
- 16 Repeat steps 3 to 6 to confirm correct operation.
- 17 Press <Window> key to highlight the **Tx-Transmitter Settings window** and set the **Laser to OFF**.
- 18 Disconnect all loopback connections.

What to do if the Test fails



Always ensure Optical Output Laser LEDs beside ports are OFF while making/changing optical connections.

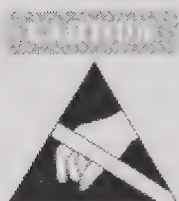
- 1 Check all connections and make sure that the correct loopback connection is in place for the interface being checked. Make sure connectors are located in key/notch of the port connectors to ensure full insertion.
- 2 Check Transmitter and Receiver are set to the same Signal Rate and that the correct Laser is On when test is being Run.
- 3 Press <Smart Test> then select **Shortcuts > Signal Power** and check the Received signal level is in the Green BER measurement power range.
- 4 Ensure all optical connections are clean and fully connected with no sharp bends or twists in the optical patch cord. Check the Optical Cord and Attenuator are not damaged and/or substitute with equivalent
- 5 Power down unit and use recognized cleaning kit to clean connectors before retrying the Tests.

If the problem persists then contact your local Agilent Sales/Service representative.

Connecting to the Network

Connectors for connecting to the network are located on the top of the Transmission Test Set. The connections available depend on the options fitted to your instrument.

Before connecting, note the Warning and Caution information given.



When connecting or disconnecting, ensure that you are grounded or, make contact with the metal surface of the Mainframe with your free hand to bring you, the module, and the mainframe to the same static potential. Modules remain susceptible to ESD damage while the module is installed in the Mainframe. Additional ESD information is required when servicing,

Optical Interface Connectors

For your protection, review all laser information given in this manual before installing or using the instrument.



To prevent personal injury, avoid use that may be hazardous to others, and maintain the test set in a safe condition. Ensure the information given below is reviewed before operating the test set.

Laser Product Classification

All optical modules are classified as Class I (non-hazardous) laser product in the USA which complies with the United States Food and Drug Administration (FDA) Standard 21 CFR Ch.1 1040.10, and are classified as Class 1 (non-hazardous) laser products in Europe which complies with EN 60825-1 (1994).

To avoid hazardous exposure to laser radiation, it is recommended that the following practices are observed during system operation:

- ALWAYS DEACTIVATE THE LASER BEFORE CONNECTING OR DISCONNECTING OPTICAL CABLES.

- When connecting or disconnecting optical cables between the test set and device-under-test, observe the connection sequences given below.

Connecting: Connect the optical cable to the input of the device-under-test before connecting to any of the test set's Optical Out connectors. When connecting to the Transmission Test Set Optical In ports ensure the power level never exceeds the maximum stated limit for that port.

Disconnecting: Disconnect the optical cable from the test set's Optical Out connector before disconnecting from the device-under-test. Always close the fibre optic connector dust caps over the laser aperture.

- NEVER examine or stare into the open end of a broken, severed, or disconnected optical cable when it is connected to one of the Transmission Test Set Optical Out connectors.
- Arrange for service-trained personnel, who are aware of the hazards involved, to repair optical cables.

Laser Warning Symbols

The Transmission Test Set Connector panel has the following label:

CLASS 1 LASER PRODUCT

CLASS 1 LASER PRODUCT translates as follows:

Finnish - LUOKAN 1 LASERLAITE

Finnish/Swedish - KLASS 1 LASER APPARAT

This label indicates that the radiant energy present in this instrument is non-hazardous.

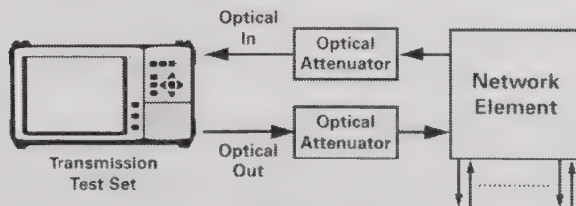
Avoiding Optical Receiver Overload

Check that when connecting an optical transmitter to an optical receiver that you do not overload the receiver. This applies to elements under test and also the Transmission Test Set receiver input ports.

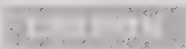
Adjacent to each of the Transmission Test Set Optical In and Optical Out ports is given the following power level information:

Optical Out ports: The maximum available output power is given.

Optical In ports: The maximum input power (Damage level) the receiver input can accept before damage occurs. Also the recommended input power range for signals applied to the receiver.



When performing tests, it is recommended that you drive the optical receiver with a signal that has an average power in the middle of the receiver's operating range (mid-way between the upper and lower levels printed next to the Optical In port).



1. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
2. Always fit the fibre optic connector dust caps on each connector when not in use. Before connection is made, always clean the connector ferrule tip with acetone or alcohol and a cotton swab. Dry the connector with compressed air. Failure to maintain cleanliness of connectors is liable to cause excessive insertion loss

Additional Precautions for Service Engineers

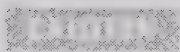
Safety Precautions

DO NOT substitute parts or modify equipment. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure the safety features are maintained.

DO NOT service or adjust alone. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, service personnel must not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Review “Safety Precautions for the Operator” on page 21.

ESD Precautions



When making connections to the Transmission Test Set, review “Connecting to the Network” on page 40

The Transmission Test Set contains components sensitive to electrostatic discharge. To prevent component damage, carefully follow the handling precautions presented below.

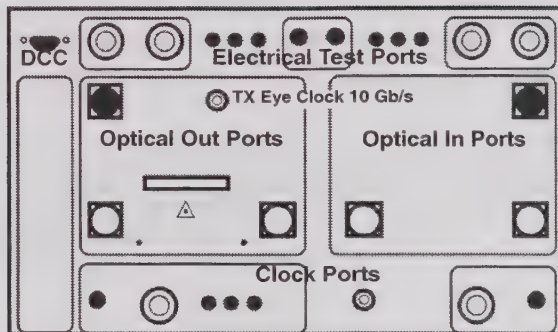
The smallest static voltage most people can feel is about 3500 volts. It takes less than one tenth of that (about 300 volts) to destroy or severely damage static sensitive circuits. Often, static damage does not immediately cause a malfunction but significantly reduces the component's life.

Adhering to the following precautions will reduce the risk of static discharge damage.

Keep the assembly in its conductive storage box/bag when not installed in the Mainframe. Save the box/bag for future storage of the assembly.

Connectors

Top Panel Connectors



Optical Out Ports

Provides SONET optical signals OC-1, OC-3, OC-12, OC-48, OC-192, and SDH optical signals STM-0, STM-1, STM-4, STM-16, STM-64 at wavelength 1310 and 1550 nm, depending on instrument model and options.

52 Mb/s - 2.5 Gb/s 1310 nm

Selectable optical connector (see Table 1 on page 45) for a 52 Mb/s to 2.5 Gb/s optical output. Nominal wavelength is 1310 nm. Power output is -5 to +0 dBm.

52 Mb/s - 2.5 Gb/s 1550 nm

Selectable optical connector (see Table 1 on page 45) for a 52 Mb/s to 2.5 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -2 to +3 dBm.

10 Gb/s, 1550 nm

Selectable optical connector (see Table 1 on page 45) for a 10 Gb/s optical output. Nominal wavelength is 1550 nm. Power output is -1 to +1 dBm.

Table 1 Optical Connectors

Optical Connector	Order Option
FC/PC Adapters fitted on all optical interfaces	190
SC Adapters fitted on all optical interfaces	191
ST Adapters fitted on all optical interfaces	192

Optical In Ports

Accepts SONET OC-1, OC-3, OC-12, OC-48, OC-192 signals, and STM-0, STM-1, STM-4, STM-16, STM-64 depending on the model and options fitted.

52 - 622 Mb/s

Selectable optical connector (see Table 1 on page 45) for a 52 Mb/s to 622 Mb/s optical input (OC-1, OC-3, OC-12/STM-0, STM-1, STM-4 signals). Wavelength 1200 to 1600 nm. Input damage power >+3 dBm; never exceed maximum input power. The recommended input power operating level for OC-1, OC-3/STM-0, STM-1 signals is -33 to -10 dBm and for OC-12/STM-4 signals -28 to -8 dBm.

2.5 Gb/s

Selectable optical connector (see Table 1 on page 45) for a 2.5 Gb/s optical input (OC-48/STM-16 signals). Wavelength 1200 to 1600 nm. Input damage power >+3 dBm; never exceed

maximum input power. The recommended input power operating level for OC-48/STM-16 signals is -28 to -8 dBm.

10 Gb/s

Selectable optical connector (see Table 1 on page 45) for 10 Gb/s (OC-192/STM-64) optical input signals. Wavelength 1200 to 1600 nm. Input damage power $>+1$ dBm; never exceed maximum input power. The recommended input power operating level for OC-192/STM-64 signals is -20 to -9 dBm.

Clock Ports

2 Mb/s 2 MHz Clock In

BNC 75 ohm nominal unbalanced connector for a 2 Mb/s and 2 MHz MTS external clock source input.

2 Mb/s 2 MHz Clock In

3-pin Siemens connector for a 2 Mb/s and 2 MHz MTS external clock source input.

DS1 Clock In

Bantam 100 ohm nominal connector for a DS1 BITS external reference clock input.

2 MHz Clock Out

BNC 75 ohm nominal unbalanced connector for a 2 Mb/s and 2 MHz MTS clock reference output. Generated relative to the selected transmit reference clock.

DS1 Clock Out

Bantam 100 ohm (nominal) connector for a DS1 BITS clock reference output. Generated relative to the selected transmit reference clock.

TX Eye Clock 52 - 2.5 Mb/s

SMA connector providing a TX Eye Clock signal (at 1/4 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

TX Eye Clock 10 Gb/s

SMA connector providing a TX Eye Clock signal (at 1/16 of the line rate) which can be used to trigger an oscilloscope when examining data signals.

DCC Port

Connector: 9-pin miniature D-type.

Use this port to insert and drop either the D1-D3 DCC channel or the D4-D12 DCC channel. The first bit of data inserted will be put into the MSB of the DCC channel. The MSB of the dropped data bytes will be output first. The transmit (drop) and receive (insert) capabilities are independent, that is the transmit and receive clock rates can be set to different rates. Note that the instrument acts as a DCE (Data Communications Equipment), that is, it will supply the clock signal for both drop and insert operation.

Pin Number	RS-449/422 Circuit
1	Rx Data Output (+)
2	Rx Clock Output (+)
3	Signal ground
4	Tx Clock Output (+)
5	Tx Data Input (+)
6	Rx Data Output (-)
7	Rx Clock Output (-)
8	Tx Clock Output (-)
9	Tx Data Input (+)

Rate: D1-D3 DCC: 192 kb/s
D4-D12 DCC: 576 kb/s.

Signal Type: Unipolar differential signal as defined in ANSI EIA-422-B and EIA-423-B.

Input Termination: 100 ohms differential.

Input Sensitivity: 500 mV over a ± 15 V common mode range and 200 mV over a ± 7 V range.

Electrical Test Ports

J2129A enhanced testing product is required for these ports to be active.

SONET/SDH Out

BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical output.

SONET/ SDH In

BNC 75 ohm unbalanced connector for an STS-1/STM-0 (B3ZS) or STS-3/STM-1 (CMI) electrical input. Input Mode - Terminate or Monitor. Monitor mode conforms to G.772-1993. Monitor Gain - 20 or 26 dB.

2 Mb/s Out

3-pin Siemens 120 ohm balanced connector for an E1 Transmit or E1 Drop signal output. Either this port or the 2-140 Mb/s, DS3 unbalanced Out port can be active for the E1 Transmit function.

2 Mb/s In

3-pin Siemens 120 ohm balanced connector for an E1 Receive or E1 Insert signal input. Either this port or the 2-140 Mb/s DS3 unbalanced In port can be active for the E1 Receive function.

DS1 Out

Bantam 100 ohm balanced connector for a DS1 Transmit or DS1 Drop signal output.

DS1 In

Bantam 100 ohm balanced connector for a DS1 Receive or DS1 Insert signal input.

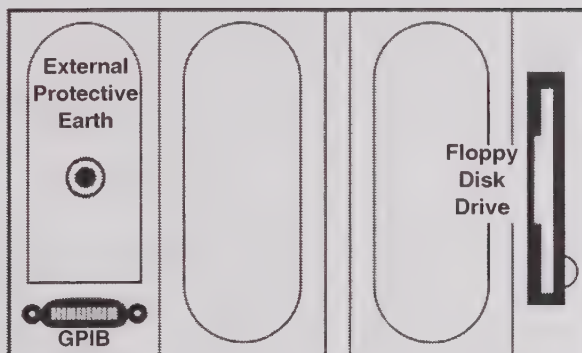
2-140 Mb/s DS3 Out

BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 transmit or E1, E3, E4, DS3 Drop signals. Either this port or the 2 Mb/s Out balanced port can be active for the E1 Transmit function.

2-140 Mb/s DS3 In

BNC 75 ohm unbalanced connector for E1, E2, E3, E4, DS3 receive or E1, E3, E4, DS3 Insert signals. Either this port or the 2 Mb/s balanced In port can be active for E1.

Connectors on Instrument Front/Left Side Panel

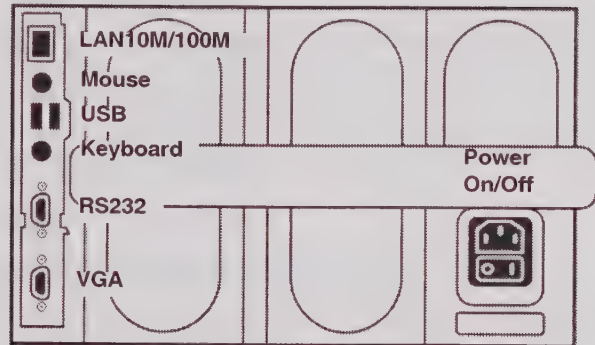


GPIB

Allows test set to be remotely controlled via the GPIB control bus.

External Protective Earth

Connectors on Instrument Front/Right Side Panel



LAN 10M/100M

10/100 Base-T LAN interface port. Supports remote control of test set and the downloading of firmware upgrades.

10 Base-T LAN Connection Radiated Emissions To ensure compliance with EN 55011 (1991) a category 5, STP patch lead, RJ45 cable should be used to connect to the LAN port.

Mouse

PS/2 port for connecting a mouse. Activation of this port is planned as a future enhancement (no timing details available at time of printing).

USB

Two Universal Serial Bus ports for connecting to a Printer and Modem. J2129A enhanced testing product required for Modem.

Keyboard

PS/2 port for connecting an external keyboard.

RS232

Remote Control port providing following configurations:

Controller Type: Computer and Terminal.

Protocol: None and Xon/Xoff.

Speed: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 baud.

Parity: Odd, Even, 1s, 0s.

Stop Bits: 1, 2

Data Length: 7 bits.

VGA

Connector for displaying contents of instrument screen on an external display. Ensure that the external display is connected before powering up the instrument.

Front Panel Soft Recovery (Cold Start)

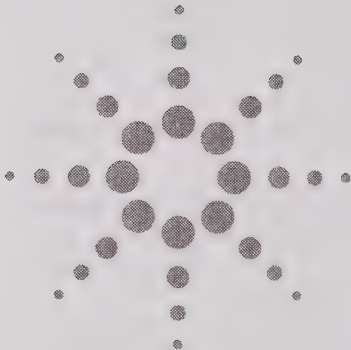
An instrument “cold start” routine is provided to reset the instrument in the event of an unplanned hardware or firmware event. A cold start reboots the instrument and restarts the instrument from a default configuration file, erasing existing configuration information. Performing a cold start will therefore cause the current menu settings to be lost and will cause the instrument to power up in its default state.

Performing a Cold Start

- 1 Switch the instrument off and wait a few seconds.
- 2 Switch the instrument on and as the instrument boots up, look carefully at the display.
- 3 Wait for the “Initialising instrument” text to be displayed. After a few seconds start to repeatedly press the **<Menu>** key until the Agilent splash screen appears with an options menu in the top left corner of the display.

The following options are available:

- 1 Reload configuration.
 - 3 Cold start.
 - 5 Normal start.
 - 6 Upgrade software.
- 4 Press 3 on the numeric keypad to select cold start.
 - 5 The unit will then continue with the boot up process.
 - 6 When the boot-up procedure is complete, the instrument displays a dialog box with the message
“Instrument reset to default settings.”



3

Performance Tests

Introduction	56
Recommended Test Equipment	57
Recall Default Settings	59
Performance Self Test	60
Internal Reference Clock Accuracy	65
External Clock Reference Inputs & Clock Reference Output	71
Optical Pulse Mask and Output Characteristics	78
Optical Receiver Sensitivity, Optical Power & Frequency Measurement	89
Performance Test Record	106



Introduction

The procedures given in this Section test the performance of the J2126/7A - Transmission Test Set using the instrument specifications for test accuracy limits. The tests are intended to be performed in the recommended order for a full instrument calibration check. Tests can be run individually, however it will be assumed that any preceding test would meet specifications.

Equipment Required

Equipment required for the Performance Tests is given in “Recommended Test Equipment” on page 57. Any equipment which meets or exceeds the critical specification of the equipment listed, may be substituted. Recommended models are those typically used in Agilent Service Centers. Where appropriate alternative models are also listed.

Performance Test Record

The results of the Performance Tests may be recorded in the “Performance Test Record” on page 106. The Performance Test Record lists all the tested specifications and the acceptable limits. The results recorded at incoming inspection may be used for comparison during periodic maintenance, troubleshooting or after repair or adjustment.

Calibration Check Cycle

This instrument requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked approximately once every 2 years, using these Performance Tests.

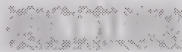
Instrument Model and Option Configuration

Please refer to Chapter 1 and the instrument Specifications for information on option configuration.

Recommended Test Equipment

Instrument	Critical Specification	Recommended Model
High Speed Optical Oscilloscope	Oscilloscope Mainframe 3GHz Opt/Elect Module with STM-1/4 Filter 20GHz Opt/Elect Module with STM-16/64 Filter.	86100A 86103A opt 201 86105A opt 202
Oscilloscope with Communications Mask Kit	> 400MHz BW, Communications mask measurement kit with appropriate connectors/adaptors. Capability. DS1 to STS-3/STM-1e	54810A opt 100 (option 100 provides E2625A Communication Mask test kit)
Frequency Counter	Range 0 to 200 MHz, accuracy <0.1ppm.	53181A opt 001 or 5325A opt 010
Optical Power Meter and Sensor Module	Range -8 dBm to -33 dBm, Wavelength 1260-1600 nm	8163A & 81633A or 8153A & 81536A
Optical Attenuator	Wavelength 1200 - 1600 nm, Range 0 - 30 dB	8156A opt 100 or 8157A
FC/PC Optical Interface Connector	Unique	81000FI (Qty 4)
Optical Cables	Unique	1005-0337 (Qty 2)
PDH/DSn Structured Test Set	Unique	OmniBER 718, with option 012 or OmniBER 719 with option 013
75Ω Attenuator Kit	0 to 200 MHz 3, 6, 10, 20 dB fixed attenuator pads	86213A
Cable Simulator #E1	75Ω coaxial cable 6 dB loss at 1 MHz	8120-0049 (120 m)*
Cable Simulator #E2	75Ω coaxial cable 6 dB loss at 4 MHz	8120-0049 (80 m)*
Cable Simulator #E3	75Ω coaxial cable 12 dB loss at 17 MHz	8120-0049 (120 m)*
Cable Simulator #E4	75Ω coaxial cable 12 dB loss at 70 MHz	8120-0049 (80 m)*
Cable Simulator #DS1	75Ω coaxial cable. Equivalent to 655 feet ABAM cable.	8120-0049 (80m)*
Cable Simulator #DS3	75Ω coaxial cable. Equivalent to 450 feet of 728A cable	8120-0049 (55m)*
Cable Simulator STM-0/STS-1	75Ω coaxial cable 6 dB loss at 26 MHz	8120-0049 (50 m)*
Cable Simulator STM-1/STS-3	75Ω coaxial cable 12 dB loss at 78 MHz	8120-0049 (75 m)*

Instrument	Critical Specification	Recommended Model
75 Ω Termination	0 to 200 MHz	15522-80010
T Connector	BNC to Dual BNC	1250-0781
Adaptor	BNC(m) to SMA(f)	E9632A
Cable	SMA to SMA	8120-4948
Adaptor	Type N to BNC	1250-1534 (Qty 2)
Adaptor	Type N to N	1250-1528 (Qty 2)
Balanced/Unbalanced Converter	110 Ω balanced: 75 Ω Unbalanced (nominal)	15508B (Qty 2)



Cable lengths quoted are typical for the half bit rate loss. Ideally cables should be trimmed to correct length/loss by measuring with a Network Analyzer. Combinations of cable lengths i.e. 80, 40, 15 & two 10m cables, can be used to provide the required cable simulations.

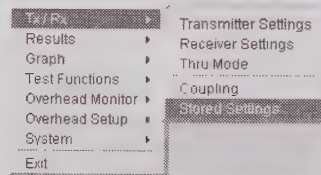
Self Test Loopback Cables and Accessories

- 1005-0337 1m fibre optic cable FC/CP connectors.
- 1005-0433 FC/CP 15 dB attenuator.
- 15525A 75 ohm BNC, 2 off.
- 15512A Siemens 3 pin.
- 15670A Bantam 110 ohm.
- J2125-65011 DCC Port 9 pin loopback plug.
- Formatted floppy disk.

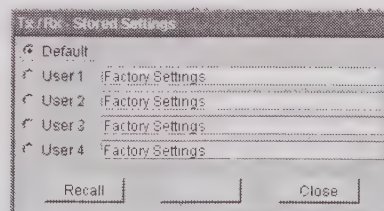
Recall Default Settings

The Performance Tests require the Transmission Test Set to be set to a pre-defined (default) state at the beginning of each test.

- 1 Press **<Menu>** and select **Tx/Rx > Stored Settings**.



- 2 Select **Default** then **Recall**.



- 3 Select **OK**, then wait a few seconds for instrument to reconfigure to the default settings. Recall has completed when the dialog box clears.
- 4 Select **Close** on the Tx/Rx - Stored Settings window.

Performance Self Test

Part of the instrument Self Test is used for the Performance Tests. This provides a high degree of confidence that the relevant measurement hardware is operating correctly in advance of completing the Performance Tests.



A full overview of the Self Test is given later in the manual.

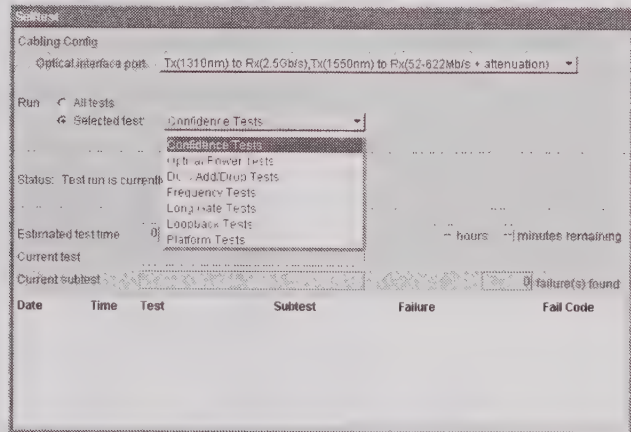
This section gives an description of the Self Tests that are required to be completed as part of the Performance Tests and covers the following

- Description of the Self Tests.
- Loopback connections required for Self Test
- How to run the Self Test.
- What to do if the Self Test fails.

Description of the Performance Self Test

The Self Test comprises of a selection of tests covering different areas of hardware in the instrument. For the purposes of the Performance Self Tests, the **Confidence Test** and the **Frequency Measurement Test** should be completed. These are selected from the main Self Test menu. If a failure occurs during a test then a descriptive text message and Fail Code is returned.

The Self Test is selected by pressing the <MENU> key and selecting **System** > **Self Test**. An example of the Self Test page is shown below.



Loopback connections required for Self Test

The Confidence Test verifies all the optical and electrical (instruments with J2129A only) test ports on the unit therefore loopback connections are required on the instrument. The following loopback connections are required (see illustration).

Optical Loopback Connections (required on all instruments)

- Use optical cables P/N 1005-0337 and 15dB attenuator P/N 1005-0433

Connect 10Gb/s 1550nm Optical Out <> 15dB Attenuator <> 10Gb/s Optical In

Connect 52Mb/s-2.5Gb/s Optical Out <> 15dB Attenuator <> 2.5Gb/s Optical In

Connect 52Mb/s-2.5Gb/s Optical Out <> 15 dB Attenuator <> 52Mb/s-622Mb/s Optical In

Electrical connections 155Mb/s to 8Mb/s (instruments with J2129A only)

- Use BNC cables P/N 15525A

Connect 52/155Mb/s Out (BNC) <> 52/155Mb/s In (BNC)

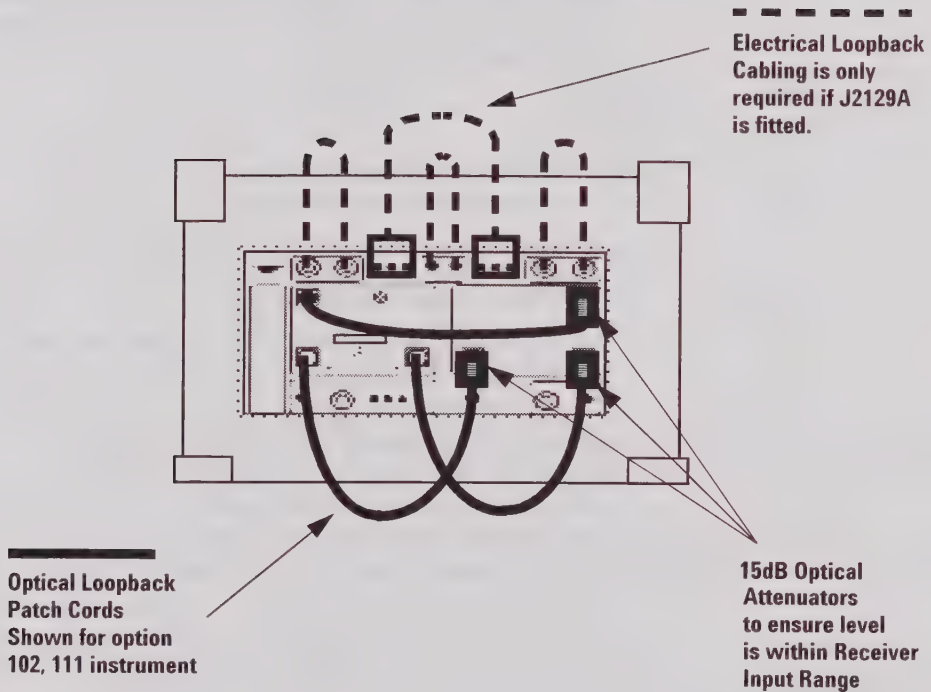
Connect 2-140Mb/s DS3 Out (BNC) <> 2-140Mb/s DS3 In (BNC)

Balanced electrical connections 2M/DS1 (instruments with J2129A only)

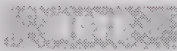
- Use 3-pin Siemens cable P/N 15512A and Bantam cable P/N 15670A

Connect 2M Out (3-pin Siemens) <> 2M In

Connect DS1 Out <> DS1 In



Self Test Loopback Connections



If only a single wavelength optical port is fitted for 2.5Gb/s - 52Mb/s Optical Out (e.g. Option 100/101), then the Self Test should be performed twice to verify all the Optical In ports. Perform the test with the 2.5Gb/s-52Mb/s Optical Out port connected to the 2.5Gb/s Optical In port and repeat with the 2.5Gb/s-52Mb/s Optical Out port connected to the 662-52Mb/s Optical In port. Select the cable configuration from the test menu as appropriate.



Safety precautions care and connection cleanliness must be observed to ensure that the optical connections are not damaged or degraded. Ensure the recommended optical attenuation is present in all optical loopback connections as failure to do so could cause self test failure or damage to the optical receivers.

How to run the Self Test

- 1 The Self Test is selected by pressing the <MENU> key and selecting **System > Self Test**.
- 2 Ensure all loopbacks are in place and from the Self Test page menu select the appropriate 1310/1550nm 2.5G - 52M optical loopback Cabling Configuration.
- 3 On the Self Test page choose **Run Selected Test** and choose **Confidence Test**. Choose START to begin the test.
- 4 The Self Test will now run selecting each sub-test in sequence. The elapsed test time and remaining test time is displayed.
- 5 If any sub-test fails an error message and error code will be returned. Up to six errors are recorded.
- 6 On the Self Test page choose **Run Selected Test** and choose **Frequency Measurement**. Choose START to begin the test.

Further information on the Self Test can be obtained in the Self Test Overview section at the rear of this manual.

What to do if the Self Test fails

- 1 Check all connections to make sure that all the correct loopback connections are in place.
- 2 Be suspicious of any optical interface failures and if necessary clean all optical connections with a recognized cleaning kit before retrying the Self Test.
- 3 If the problem persists then contact your local Agilent Service Office or representative.

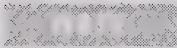
Internal Reference Clock Accuracy

Specification

Clock Output	Frequency	Accuracy
2MHz	2.048MHz	± 4.5 ppm
DS1 (BITS Clock)	1.544MHz	± 4.5 ppm

Accuracy of Transmitter Internal Clock

- Settability ± 0.5 ppm
- Stability ± 3 ppm over temperature range
- Ageing ± 1 ppm/annum



The 2MHz output is only available when SDH or En rate is selected on the Transmitter. The DS1 output is only available when SONET or T-Carrier rate is selected on the Transmitter.

BITS Clock is not a binary format signal. Signal is a Ternary All 1's DS-1 signal with ESF Framing, clocked at 1.544 MHz.

Description

The test uses a Frequency Counter or DS_n Test Set connected to the appropriate Clock output port. When the Transmitter is set to Internal Clock the reference output is derived from the instrument internal 10MHz reference which is also used in main signal generation.

An alternative test method using the Frequency Counter is provided for the DS1 check if a suitable DS_n Test Set is not available. However, in this case it should be noted that as this signal is a Framed All '1's Ternary signal the expected result on the Frequency Counter is offset due to the effect of Framing Bits in the signal.

Equipment Required

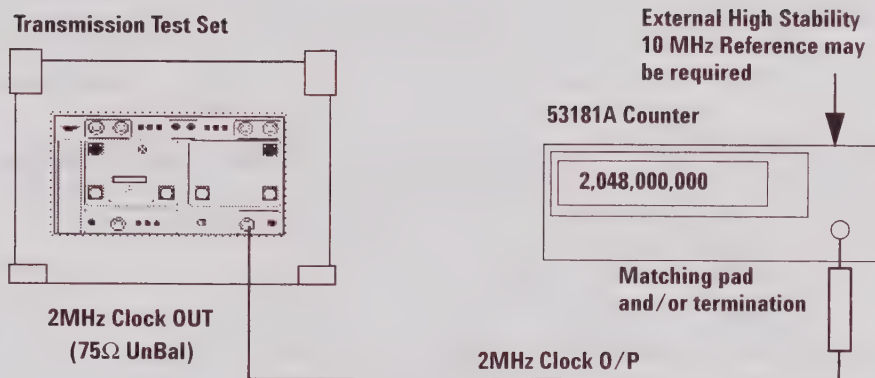
Frequency Counter	: Agilent 53181A Option 010,015 (see Note)
DSn Test Set	: Agilent 37718C with Option 012
Bantam/Bantam Cable	: Agilent 15670A
75/50 ohm Matching Pad	: Agilent E2629A
Bal/Unbal Converter	: Agilent 15508B



For accuracy required the counter **MUST** have high stability Internal Timebase option or be externally referenced to an in-house Standard.

Procedure

- 1 Recall the Transmission Test Set's default settings as shown on "Recall Default Settings" on page 59.
- 2 Set the Instrument Preferences to SDH Format. To do this, Press <Menu>, select **System** > **Preferences** and set **Network Standard** to **SDH**.
- 3 Connect the Transmission Test Set's 2MHz Clock Out port to the Frequency Counter Input using a 75/50Ω matching pad, set the input impedance to 50Ω. Alternatively, a 75Ω termination can be used with the input impedance set to 1MΩ.



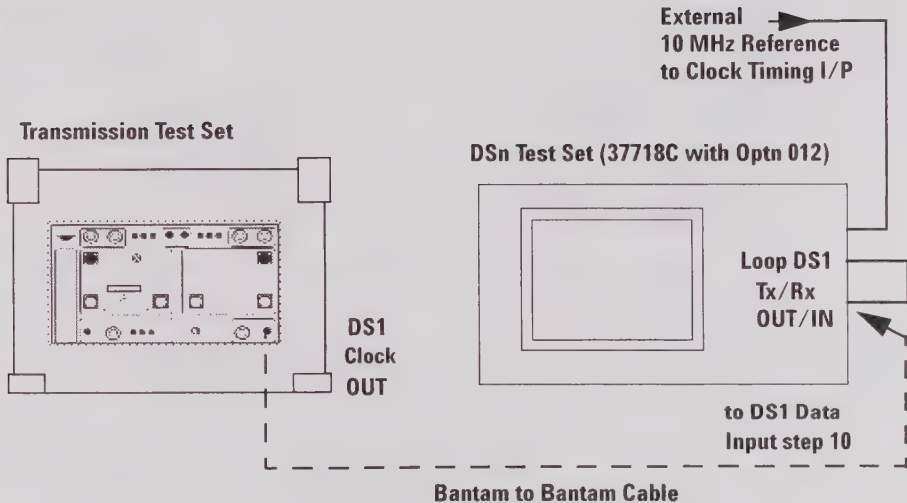
- 4 Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between

2.0479908 MHz and 2.0480092 MHz.



The reading should be well within these limits. However, after several years of operation the main reference oscillator may need adjustment optimized to compensate for drift/ageing. If necessary contact your local Agilent Service for advice. Before doing so ensure the Counter being used has the appropriate internal/external reference accuracy.

- 5 Set the Transmission Test Set Transmitter Output to SONET Format. To do this, Press <Menu>, select **System > Preferences** and set **Network Standard** to **SONET**.
- 6 Connect the DS1 Transmit OUT to Receive IN ports of the Test Set using a Bantam to Bantam cable. Also connect an External 10MHz Reference signal to the Test Set 10M CLOCK Input port.



7 Setup the Test Set Settings as follows:

Tx/Rx to COUPLED mode.

SIGNAL to DS1 rate

PAYLOAD TYPE to ESF UNSTRUCTURED

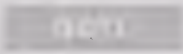
PATTERN to ALL ONES

Set the Transmitter CLOCK to EXTERNAL 10 MHz REF



This ensures the Test Set transmitter generates a DS1 signal locked to the External 10 MHz reference signal, e.g. in-house Standard. The signal is looped to the Test Set receiver to take note of the receiver frequency measurement accuracy/error.

8 Check there are no Alarms/Errors indicated by the Test Set Receiver.

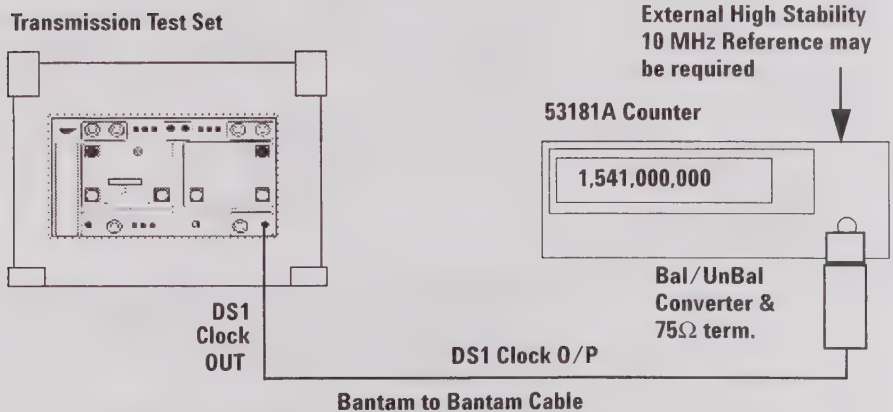


If the Test Set CLOCK LOSS led is ON check the external reference signal.

- 9** Set the Test Set to display the Frequency Measurement and ppm Offset results and check these are between
1543993 and 1544007 Hz.
-4.5 and +4.5 ppm
- 10** Change the test setup as follows. Disconnect the loopback connection between Test Set Tx/Rx then connect the Transmission Test Set DS1 Clock Out port to the Test Set DS1 Receive port using the Bantam to Bantam cable.
- 11** Check there are no Alarms/Errors indicated by the Test Set Receiver.
- 12** Set the Test Set to display the Frequency Offset Measurement result and check this is between
-9 ppm and +9 ppm
- 13** Subtract the ppm Test Set error noted in step 9 from the result in step 12 to give the Transmission Test Set Transmitter DS1 Bits frequency error in ppm and check this is between
-4.5 and +4.5 ppm
- 14** Test Complete.

Alternative DS1 Clock test (if suitable DS_n Test Set is not available)

- 1 Connect the Transmission Test Set's DS1 Clock Out port to the Frequency Counter Input using a 110/75Ω Bal/Unbal Converter and 75Ω termination. Set the Frequency Counter input impedance set to 1MΩ.



As the DS1 Clock Output is a Framed All '1's signal the average frequency measured by the Counter will be less than expected, e.g. 1541000 Hz rather than 1544000 Hz due to the effects of Framing Bits in the signal. The Ternary format of the signal can also mean that depending on input attenuation/trigger setting the counter may trigger on exactly half the signal rate e.g. 770500 Hz.

- 2 Adjust the Frequency Counter Trigger Level to obtain a stable reading and it will also be necessary to increase the Gating time due to the effects of Framing Bits. Check that the Frequency Counter reads between

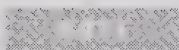
1.540993 MHz and 1.541007 MHz

- 3 Alternative Test Complete.

External Clock Reference Inputs & Clock Reference Output

Specifications

Clock Rate	Description
2.048 Mb/s MTS	Accepts timing reference as per ITU-T G.703-1998
2.048 MHz Clock	Accepts timing reference as per ITU-T G.703-1998
1.544 Mb/s BITS	Accepts DS-1 timing reference as per TA-TSY-000378



The 2MHz input is only available when SDH or En rate is selected on the Transmitter. The DS1 input is only available when SONET or T-Carrier rate is selected on the Transmitter.

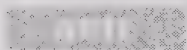
BITS Clock is not a binary format signal. Signal is a Ternary All 1's DS-1 signal with ESF Framing, clocked at 1.544 MHz.

Description

The test uses a PDH/DSn Test Set and a Frequency Counter connected to the appropriate external Clock input and output ports. When the Transmitter is set to external Clock the reference Clock output port timing and signal rate generation is derived from the external Clock source.

Equipment Required

Frequency Counter	: Agilent 53181A Option 010.015 (see Note)
DSn Test Set	: Agilent 37718C with Option 012
Bantam/Bantam Cables (2)	: Agilent 15670A
75/50 ohm Matching Pad	: Agilent E2629A
Bal/Unbal Converter	: Agilent 15508B

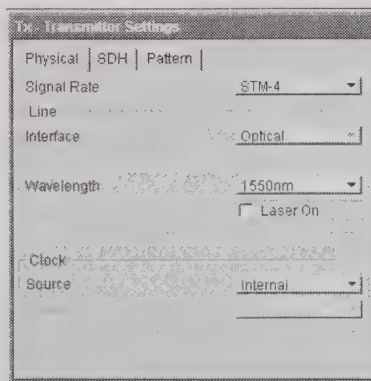


For accuracy required the counter **MUST** have high stability Internal Timebase option or be externally referenced to an in-house Standard.

Procedure

- 1 Recall the Transmission Test Set's default settings as shown on "Recall Default Settings" on page 59
- 2 Set the Instrument Preferences to SDH Format. To do this, Press <Menu>, select **System** > **Preferences** and set **Network Standard** to **SDH**.

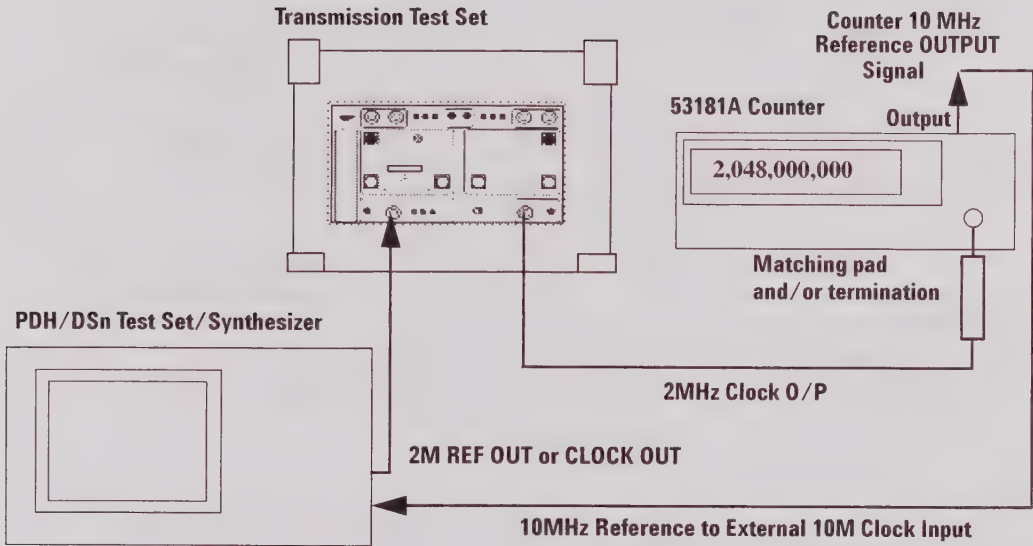
Press <Menu>, select **Tx/Rx** > **Transmitter**, select **Physical** page and set **Signal Rate** to any **STM** rate, and **Clock Source** to **External**, **Format** to **2Mb/s Clock**.



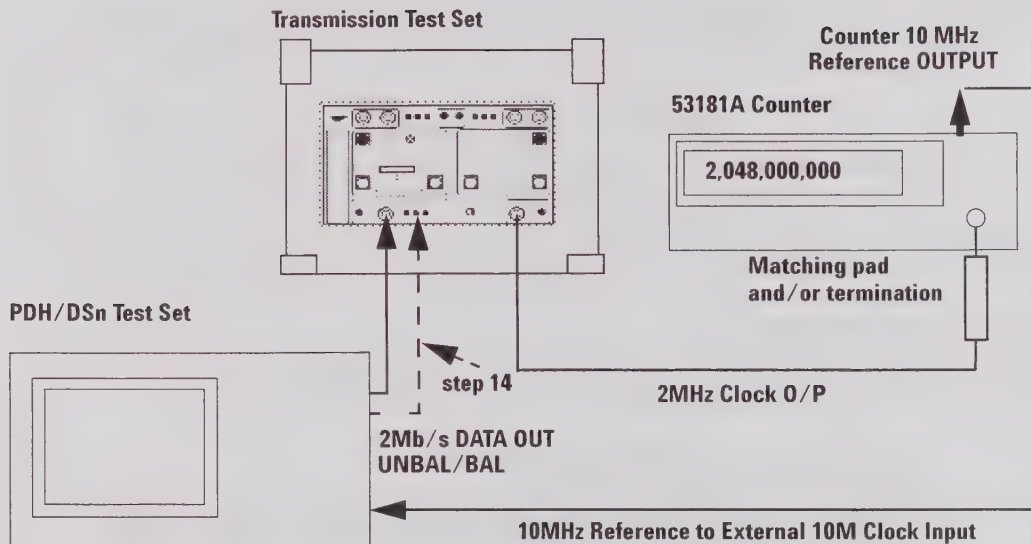
- 3 Connect the Transmission Test Set's 2MHz Clock Out port to the Frequency Counter Input using a 75/50Ω matching pad, set the input impedance to 50Ω. Alternatively, a 75Ω termination can be used with the input impedance set to 1MΩ.

Connect the Counter rear panel 10 MHz Reference Output to the PDH/DSn Test Set external 10M CLOCK input port.

Connect the PDH/DSn Test Set CLOCK REF OUT or TRANSMIT CLOCK OUT port to the Transmission Test Set CLOCK IN 2MHz BNC port.



- 4 Set the PDH/DSn Test Set Transmitter as follows.
 SIGNAL to 2Mb/s rate
 CLOCK to EXTERNAL 10 MHz REF
- 5 Check that the Test Set CLOCK LOSS Alarm Led is not lit.
- 6 Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between.
2.047999999 and 2.048000001 MHz.
- 7 Confirm that the Transmission Test Set is locked to the External signal by disconnecting/re-connecting the BNC cable at the Transmission Test Set CLOCK IN port
- 8 Change the Transmission Test Set **External Clock, Format** setting to **2Mb/s Data**.
- 9 Change the 2MHz CLOCK OUT connection at the Test Set to connect the Transmit 2Mb/s DATA out BNC to the Transmission Test Set CLOCK IN BNC port.



10 Ensure the PDH/DSn Test Set Transmitter as follows.

SIGNAL to 2Mb/s rate

CLOCK to EXTERNAL 10 MHz REF

TERMINATION to 75 ohm UNBAL

LINE CODE to HDB3

PAYLOAD TYPE to UNFRAMED

PATTERN to 2²³ PRBS

11 Check that the Test Set CLOCK LOSS Alarm Led is not lit.

12 Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between.

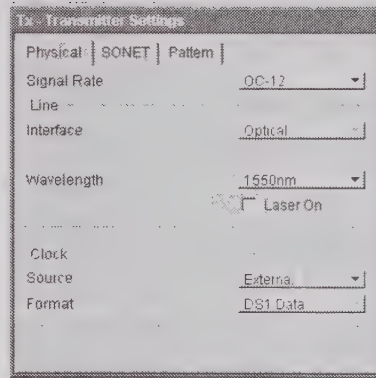
2.047999999 and 2.048000001 MHz

- 13** Confirm that the Transmission Test Set is locked to the External signal by disconnecting/re-connecting the BNC cable at the Transmission Test Set CLOCK IN port.
- 14** Change the set-up as follows. Disconnect and remove the BNC/BNC Test Set to Transmission Test Set signal connection. Connect a Balanced 3 pin Siemens cable between Test Set Data OUT 3-pin port and Transmission Test Set CLOCK IN 3 pin port.
- 15** Change the Test Set Transmit TERMINATION to 120 ohm BALANCED.
- 16** Check that the Test Set CLOCK LOSS Alarm Led is not lit.
- 17** Adjust the Frequency Counter Trigger Level to obtain a stable reading and check that the Frequency Counter reads between.

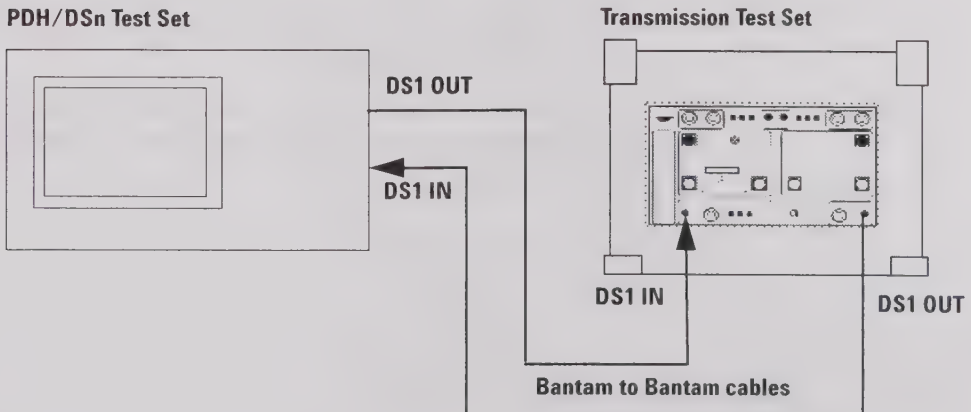
2.047999999 and 2.048000001 MHz

- 18** Confirm that the Transmission Test Set is locked to the External signal by disconnecting/re-connecting the BNC cable at the Transmission Test Set CLOCK IN port.
- 19** Set the Instrument Preferences to SONET Format. To do this, Press <Menu> and select **System > Preferences** and then set **Network Standard** to **SONET**.

Press <Menu> and select **Tx/Rx > Transmitter** and then set **Signal Rate** to any **STS/OCn** rate, **Clock Source** to **External**, **Format**, **DS1 Data**.



- 20 Connect the Test Set DS1 Transmit OUT port to the Transmission Test Set Clock IN DS1 port using a Bantam cable. Connect the Transmission Test Set's DS1 Clock Out port to the Test Set DS1 Receiver IN using a Bantam cable.



- 21 Set the PDH/DSn Test Set as follows.

TRANSMIT/RECEIVE settings to COUPLED

SIGNAL to DS1 rate

CLOCK to INTERNAL

OUTPUT LEVEL to DSX-1

LINE CODE to B8ZS

PAYLOAD TYPE to ESF UNSTRUCTURED

PATTERN to ALL ONES

- 22** Check there are no ALARMS/ERRORS detected by the Test Set Receiver
- 23** Set the Test Set to Frequency Measurement Results and check that the displayed frequency is between.

1543999 and 1544001Hz

- 24** Confirm that the Transmission Test Set is locked to the External signal by disconnecting/re-connecting the BNC cable at the Transmission Test Set CLOCK IN port.
- 25** Test complete.

Optical Pulse Mask and Output Characteristics

Specifications

Power	
1310nm	-5 to +0 dBm *
1550nm (<=2.5 Gb/s)	-2 to +3 dBm *
1550nm (10 Gb/s)	-1 to +1 dBm *
* Typical transmit power level is in the middle of the stated range.	
Extinction ratio	>8.2 dB
Pulse mask	Meets ITU-T G-957 (6/1999) and Telcordia GR-253-CORE Issue 3 (9/2000)

Description

This test ensures the Optical Transmitter(s) output power level and waveform meet the required eye mask, extinction ratio and average power specifications. The Transmitter output is connected to an Optical Oscilloscope and the eye compared with the predefined masks stored in the Oscilloscope memory. The average signal power levels and Extinction Ratio are also measured using the Oscilloscope.



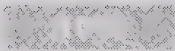
These tests are identical for SONET or SDH modes and can be tested in either mode and should not be repeated for both.

Equipment Required

High Speed Optical Oscilloscope:	• Agilent Infinium 86100A Mainframe • Agilent Infinium 86103A option 201, Optical Plug-in • Agilent Infinium 86105A option 202, Optical Plug-in
Optical Attenuator	• Agilent 8156A

- Optical Patch Cord(s)** • Agilent PN 1005-0337
- BNC(m) to SMA(f) Adapter** • Agilent E9632A
- SMA(m) to SMA(m) cable** • Agilent PN 8120-4948

Procedure



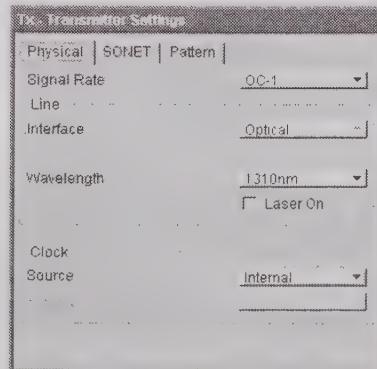
This performance test uses the Infinium 86100A Optical Oscilloscope (DCA) with appropriate Optical Plug-in modules and built-in filters. If a different oscilloscope is used refer to the scope information for Optical Eye Mask measurement.

52/155 & 622 Mb/s Optical Output Checks

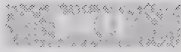
OC-1/STM-0 Power Level & Eye Mask Tests.

- 1 Recall the Transmission Test Set's default settings as shown in "Recall Default Settings" on page 59
- 2 Set the Transmitter display as shown below.

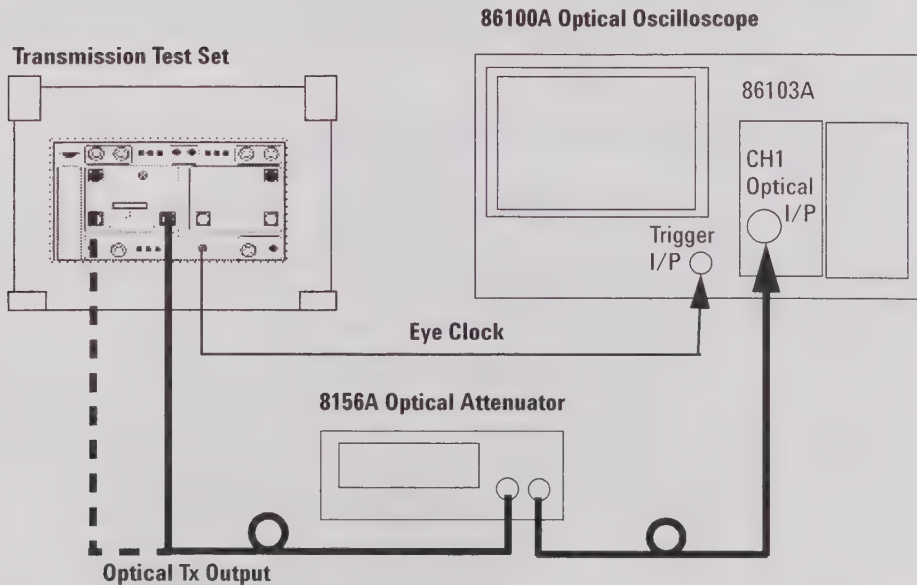
Press <Menu>, select **Tx/Rx > Transmitter** and set **Signal Rate** to **OC1/STM-0**, **Wavelength** **1310 nm** (or if this is not fitted, or already tested, select **1550 nm**). Ensure the **Laser** is set to **OFF**



- 3 Connect the 52 Mb/s Tx Optical Output Port (1310/1550nm) to the Oscilloscope via an Optical Attenuator. Set the attenuator to provide approximately 6dB attenuation, (see Note). Also connect the Eye Clock (for 52 Mb to 2.5 Gb/s Optical Tx) to the scope Trigger input.



Optical signal should be attenuated to ensure specified maximum input for 86103A (-4dBm) is not exceeded. To ensure this, Set the 8156A to 3dB, (typical 8156A attenuator insertion loss of approximately 3dB), giving approximately 6dB total attenuation.



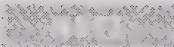
- 4 Set Transmission Test Set **Laser** to **ON** and set Optical Attenuator to Enable.
- 5 Ensure the scope Channel is set to the correct optical wavelength for the signal being tested and set Mask Filter to OFF. This is selected in the scope **Setup > Channel > Advanced settings**.

- 6 Select **Eye/Mask Mode**, **Mask Test** and select and open the **STM000_OC1.msk**.
- 7 Select scope **Autoscale** and allow the scope to find signal and trigger inputs.
- 8 Set the **Mask Mode**, **Filter** to **ON**, see Note. Start **Mask Test** and check the Optical Output meets the Mask. See example below.



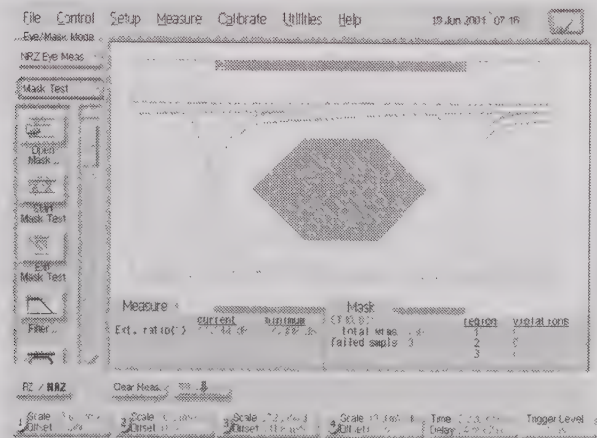
Normally an OC-1 filter would be used, however as this may not be available, it is permissible to use the OC-3 Filter for this check. The procedures for higher bit rates using OC-3, OC-12 & OC-48 filters will give confirmation that laser overshoot response is as expected.

- 9 Set the scope to **Eye Measure** mode and select **Extinction Ratio** measurement.



Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the scope channel and vertical sensitivity range to ensure measurement accuracy. Refer to scope information/Help if necessary.

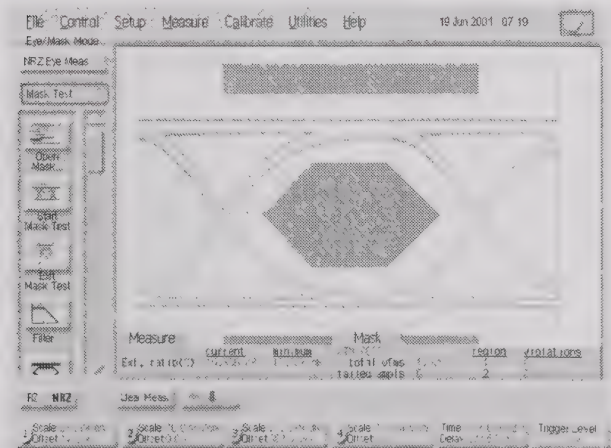
- 10 Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.



OC-1/STM-0 Eye Mask

OC-3/STM-1 Power Level & Eye Mask Tests

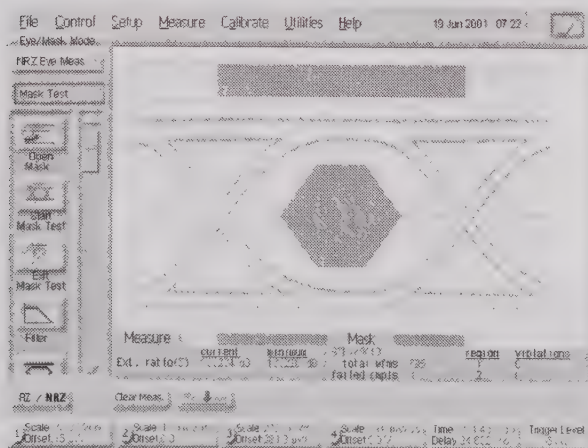
- 11 Change the Transmission Test Set **Transmitter > Signal Rate** to **OC3/STM-1**.
- 12 Ensure the scope Channel 1 Mask Filter is set to OFF.
- 13 Select **Eye/Mask Mode**, **Mask Test** and select and open the **STM001_OC3.msk**.
- 14 Select scope **Autoscale** and allow the scope to find signal and trigger inputs.
- 15 Set the **Mask Mode, Filter** to **STM-1/OC-3, ON**. Start **Mask Test** and check the Optical Output meets the Mask. See example below.
- 16 Set the scope to **Eye Measure** mode and select **Extinction Ratio** measurement.
- 17 Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.



OC-3/STM-1 Eye Mask

OC-12/STM-4 Power Level & Eye Mask Tests

- 18** Change the Transmission Test Set **Transmitter > Signal Rate** to **OC12/STM4**.
- 19** Ensure the scope Channel 1 Mask Filter is set to OFF.
- 20** Select **Eye/Mask Mode**, **Mask Test** and select and open the **STM004_OC12.msk**.
- 21** Select scope **Autoscale** and allow the scope to find signal and trigger inputs
- 22** Set the **Mask Mode**, **Filter** to **STM4/OC-12**, **ON**. Start **Mask Test** and check the Optical Output meets the Mask. See example below.
- 23** Set the scope to **Eye Measure** mode and select **Extinction Ratio** measurement.
- 24** Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.

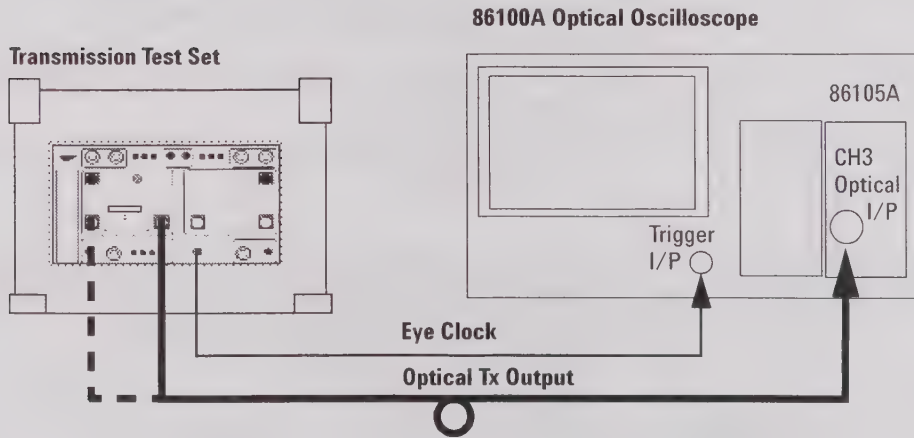


OC-12/STM-4 Eye Mask

2.5 Gb/s Optical Output Checks

OC-48/STM-16 Power Level & Eye Mask Tests

- 25 Change the Transmission Test Set **Transmitter > Signal Rate** to **OC48/STM-16**. Set **Laser** to **OFF**.
- 26 Remove the Attenuator from the Setup and connect the **2.5Gb/s Tx Optical Output Port** (1310/1550nm) directly to the scope Channel 3 Input as shown below.



- 27 Set the Transmission Test Set **Laser** to **ON**.
- 28 Ensure the scope Channel is set to the correct optical wavelength for the signal being tested and set **Filter** to **OFF**. This is selected in the **Setup > Channel > Advanced settings**.
- 29 Select **Eye/Mask Mode**, **Mask Test** and select and open the **STM016_OC48.msk**.
- 30 Select scope **Autoscale** and allow the scope to find signal and trigger inputs

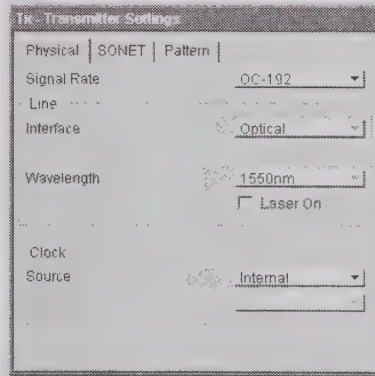
- 35** If the instrument has Dual Wavelength option (1310 and 1550 nm ports) for 51/155/622 Mb/s & 2.5 Gb/s repeat steps 1 to 34 for the 1550 nm Output and use 1550 nm settings as appropriate for scope Channel inputs.

10 Gb/s Optical Output Checks (J2127A Models only)

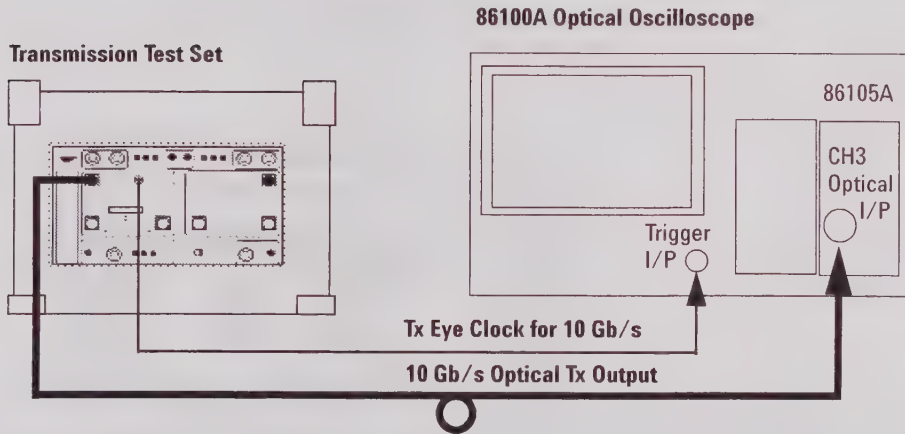
OC-192/STM-64 Power Level & Eye Mask Tests

- 1** Recall the Transmission Test Set's default settings as shown in "Recall Default Settings" on page 59
- 2** Set the Transmitter display as shown below.

Press <Menu>, select Tx/Rx > **Transmitter** and set **Signal Rate** to **OC192/STM-64**, **Wavelength** **1550 nm**. Ensure the **Laser** is set to **OFF**



- 3 Connect the **10 Gb/s Tx Optical Output Port** to the Oscilloscope using an Optical Patch cord. Also connect the **Eye Clock** (for 10 Gb/s Optical Tx) to the scope Trigger input as shown.

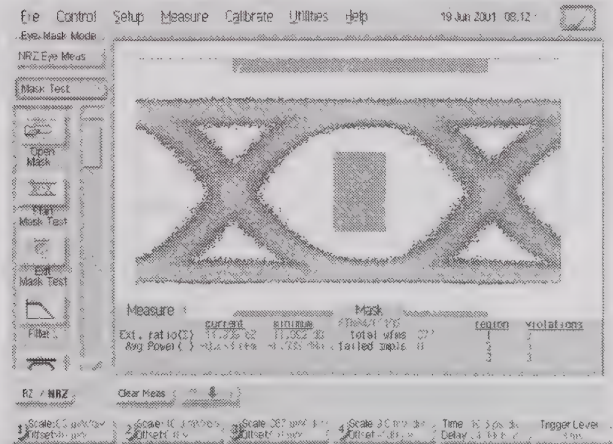


- 4 Set the Transmission Test Set **Laser** to ON.
- 5 Ensure the scope Channel is set to the correct optical wavelength for the signal being tested (i.e. 1550nm) and set Filter to OFF. This is selected in the **Setup > Channel > Advanced settings**.
- 6 Select **Eye/Mask Mode**, **Mask Test** and select and open the **STM064_OC192.msk**.
- 7 Select scope **Autoscale** and allow the scope to find signal and trigger inputs
- 8 Set the **Mask Mode**, **Filter** to **STM-64/OC-192**, **ON**. Start **Mask Test** and check the Optical Output meets the Mask. See example in Figure 8.
- 9 Set the scope to **Eye Measure** mode and setup to measure the **Average Power** (in dBm) and **Extinction Ratio**.



Ensure Vertical Calibration and Extinction Ratio Calibration have been performed for the scope channel and vertical sensitivity range to ensure measurement accuracy. Refer to scope information/Help if necessary.

- 10** Check the Average Optical Power is between **-1 to +1 dBm**
- 11** Check the Extinction Ratio is greater than **8.2 dB** and record the measured value.



OC-192/STM-64 Eye Mask

- 12** Tests Complete. Set the Laser to OFF before disconnecting setup.

Optical Receiver Sensitivity, Optical Power & Frequency Measurement

Specifications

Min. sensitivity (1)

52/155 Mb/s	-33 dBm(2)
622 Mb/s	-28 dBm
2.5 Gb/s	-28 dBm
10 Gb/s	-20 dBm(3)(4)

Max. input power (1):

52/155 Mb/s	-10 dBm
622 Mb/s	-8 dBm
2.5 Gb/s	-8 dBm
10 Gb/s	-9 dBm(4)(5)

1. For BER = 1×10^{-10} (input signal extinction ratio = 8.2 dB).
 2. Typical: < -34 dBm.
 3. Minimum sensitivity for a 1550 nm input signal (as measured at BER = 1×10^{-12} ; input signal extinction ratio = 8.2 dB). Minimum sensitivity for a 1310 nm input signal is < -19 dBm (under the same measurement conditions).
 4. Specifications for the 10 Gb/s optical receiver apply for receive signals with 1310 and 1550 nm (nominal) wavelengths. However, the 10 Gb/s receiver is a broadband device and operates over the 1200 to 1600 nm range of wavelengths.
 5. Maximum input power for a 1550 nm input (as measured at BER = 1×10^{-12} ; input signal extinction ratio = 8.2 dB). Maximum input power for a 1310 nm input is > -10 dBm (under the same measurement conditions).
-

Optical power measurement	Supported for all optical receive rates. Ranges: 10 Gb/s: -3dBm to -25 dBm. 2.5 Gb/s: 0 dBm to -28 dBm. 622 Mb/s and below: 0 dBm to -30 dBm. Accuracy: 10 Gb/s: ± 1.5 dB. 2.5 Gb/s: ± 2 dB. 622 Mb/s and below: ± 1 dB. Resolution: 0.1 dB.
Line frequency measurement	Supported for all optical and electrical receive rates. Results: Frequency (MHz), Offset (Hz and ppm). Accuracy: ± 4.5 ppm. Resolution: Frequency: 0.01 kHz (up to 622 Mb/s), 0.1 kHz.(2.5 Gb/s and 10 Gb/s). Offset: 0.1 ppm.

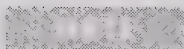


The rates & wavelengths available are dependent on the Transmission Test Set model and options fitted.

Description

The Transmitter output is attenuated and set for appropriate level using an external Power meter. The receiver sensitivity is verified using the attenuated transmitter output and checking for no errors in back-to-back mode. Checks of the receiver operation at Operating Max and Min levels is performed. The Receiver Optical Power and Frequency measurements are also checked during these tests.

Sensitivity measurements are affected by the Extinction Ratio of the laser used in the test. Receiver sensitivity specifications are quoted for worst case, i.e. minimum laser extinction ratio specification. A table is provided at the end of these tests to check the typical additional receiver sensitivity expected vs. the extinction ratio of the laser used in test.



- These tests are identical for SONET or SDH modes and can be tested in either mode and should not be repeated for both.
- Always set the Laser to OFF before changing Optical Output Port connections.
- It is most important that advice on Optical Cleanliness is adhered to ensure accuracy of these tests and to prevent damage to optical interfaces

Equipment Required

Power Meter	: Agilent 8163A
Power Meter Sensor Module	: Agilent 81633A
Optical Attenuator	: Agilent 8156A
FC/PC Connector Interface (qty 4)	: Agilent 81000FI
Optical Cables (qty 2)	: Agilent PN 1005-0337

WARNING

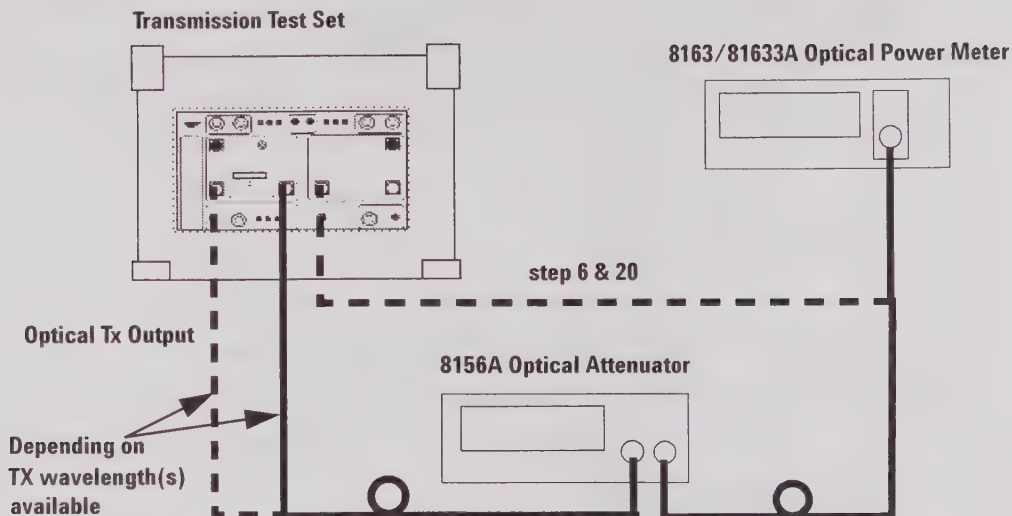
Safety precautions must be observed when handling the Transmission Test Set's Optical Modules as these generate laser signals which can cause serious injury. The guidelines below must be followed:

- Check the connector configuration of the Fiber Optic Interfaces. If non FC/PC connectors are fitted then remove them, then fit the FC/PC connector interface.
- Check for any damage to the Transmission Test Set's Fiber Optic Interface spring loaded aperture covers and connectors. Do not power up the instrument if in any doubt about the integrity of these connectors.

Procedure

OC-1/STM-0 and OC-3/STM-1 Rates

- 1 Recall the Transmission Test Set default settings as shown in "Recall Default Settings" on page 59
- 2 Connect the test set-up as shown below depending on the wavelengths installed.



3 Set the Optical Attenuator to

ATTEN 15 dB

WAVELENGTH 1310 nm (or 1550nm depending on wavelength used)

CAL=0

ENB ON.

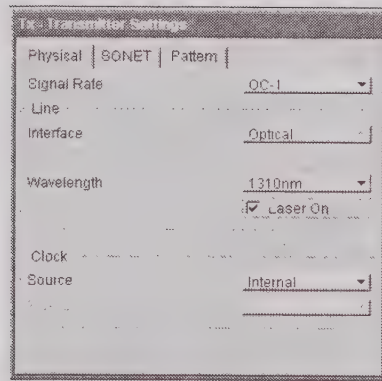
Set the Optical Power Meter to

WAVELENGTH 1310 nm (or 1550nm depending on wavelength used)

Connect the Optical Attenuator between the Power Meter and the Transmission Test Set's Optical Out port (ensure that all connections are tight and that the cable has no twists).

4 Set the Transmitter display as shown below.

Press <Menu> then select Tx/Rx > **Transmitter** and set **Signal Rate** to OC1/STM-0, **Wavelength** 1310 nm (or if this is not fitted select 1550 nm). Ensure the **Laser** is set to ON.



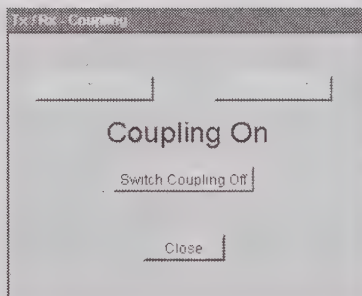
Check the laser LED is illuminated at the selected Output Port on the Transmission Test Set's connector panel.

- 5 Adjust the Optical Attenuator to obtain a reading of -33 dBm on the Power Meter (i.e. the Receiver minimum sensitivity for 52/155 Mb/s rates). Take note of the Attenuator setting.
- 6 Set the Optical Attenuator to Disable mode. Note, Do not switch OFF the Transmission Test Set laser.

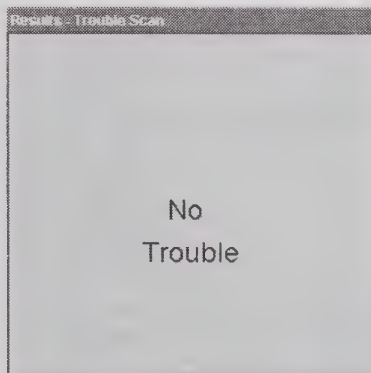
Disconnect the Optical Attenuator Output from the Power Meter and connect to the Transmission Test Set's Optical IN Port (52/155/622 Mb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the Optical Attenuator to Enable.

- 7 Set/Ensure the Transmission Test Set to **TX>RX Coupled Mode**.

Press <Menu> then select **Tx/Rx > Coupling** and select **Copy Tx to Rx**.



- 8 Press <Smart Test>, select **Shortcuts > Troublescan** then press <Run/Stop> to begin measurement.
- 9 After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected.



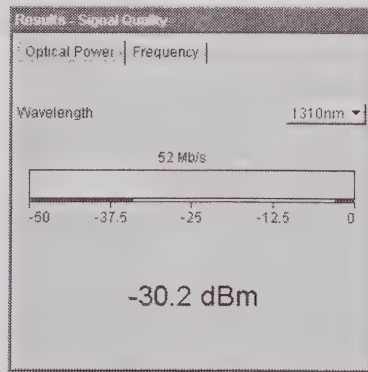
- 10 Add more attenuation by increasing the Optical Attenuator setting to find the point just before the occurrence of errors. This can be done by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically this will be at least 1 dB). Press <Run/Stop> to stop measurement.

- 11 Set the Optical Attenuator to the setting noted in step 5, then reduce setting by a further 3dB. (e.g providing -30dBm output)

Set the Transmission Test Set's Receiver to display **Optical Power** as follows. Press <Smart Test> then select **Shortcuts > Optical Power**. (set **Wavelength** to 1310/1550nm as appropriate)

Check that the optical power measurement reads between

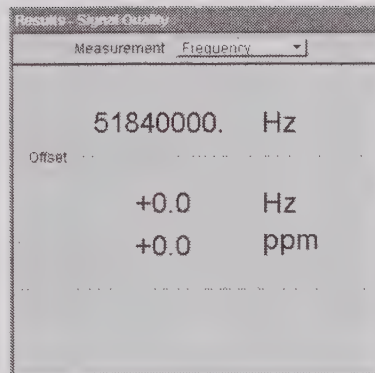
-31 and -29 dBm



Set the Transmission Test Set's Receiver Results to display **Frequency** by changing **Measurement > Optical Power** to **Frequency**

Check that the frequency measurement reads between

51.83999 and 51.84001 MHz for [STM-0 OPT] or [OC-1]
(155.51999 and 155.52001 MHz for [STM-1 OPT] or [OC-3])



- 12 Reduce the Optical Attenuator setting by a further 20dB and check the Receiver **Optical Power** result is between

-11 and - 9 dBm

- 13 Press <**Smart Test**>, select **Shortcuts > Troublescan** then press <**Run/Stop**> to begin measurement.

After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected. Press <**Run/Stop**> to stop measurement.

- 14 Disable the Optical Attenuator then disconnect the Optical signal from the Transmission Test Set Receiver port and connect to the Power Meter. Re-Enable the Optical Attenuator.

- 15 Check the Power Meter reading is between

-10.5 and -9.5 dBm

- 16 Repeat steps 4 through 15, substituting SIGNAL [STM-1 OPT] or [OC-3] in step 4.

OC-12/STM-4 Rate

- 17** Set the Transmission Test Set Transmitter to provide OC-12/STM-4 output with PRBS bulk payload as follows.

Press **<Menu>** then select **Tx/Rx > Transmitter** and set **Signal Rate** to **OC12/STM-4**, **Wavelength** **1310 nm** (or if this is not fitted select **1550 nm**). Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the selected Output Port.

Ensure the Optical Attenuator and Optical power meter are set for the Wavelength being used.

- 18** Adjust the Optical Attenuator to obtain a reading of -28 dBm on the Power Meter (i.e. the Receiver minimum sensitivity for 622 Mb/s rates). Take note of the Attenuator setting.
- 19** Set the Optical Attenuator to Disable the mode. Note, Do not switch OFF the Transmission Test Set laser.

Disconnect the Optical Attenuator Output from the Power Meter and connect to the Transmission Test Set's Optical IN Port (51/155/622 Mb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the Optical Attenuator to Enable.

- 20** Check/Ensure the Transmission Test Set is set to **TX>RX Coupled Mode**.

- 21** Press **<Smart Test>**, select **Shortcuts > Troublescan** then press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

- 22** Increase the Optical Attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB). Press **<Run/Stop>** to stop measurement.

- 23** Re-set the Optical Attenuator to the setting noted in step 18. (providing -28dBm output)

Set the Transmission Test Set's Receiver to display **Optical Power**, e.g. Press <**Smart Test**> then select **Shortcuts** > **Optical Power**. (set **Wavelength** to 1310/1550nm as appropriate) and check that the optical power measurement reads between

- 29 and -27dBm

Set the Transmission Test Set's Receiver to display **Frequency** and check that the frequency measurement reads between

622.07999 and 622.08001 MHz

- 24** Decrease the Optical Attenuator setting by a further 20 dB and check the Receiver **Optical Power** result is between

-9 and -7 dBm.

- 25** Press <**Smart Test**>, select **Shortcuts** > **Troublescan** then press <**Run/Stop**> to begin measurement.

After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected. Press <**Run/Stop**> to stop measurement.

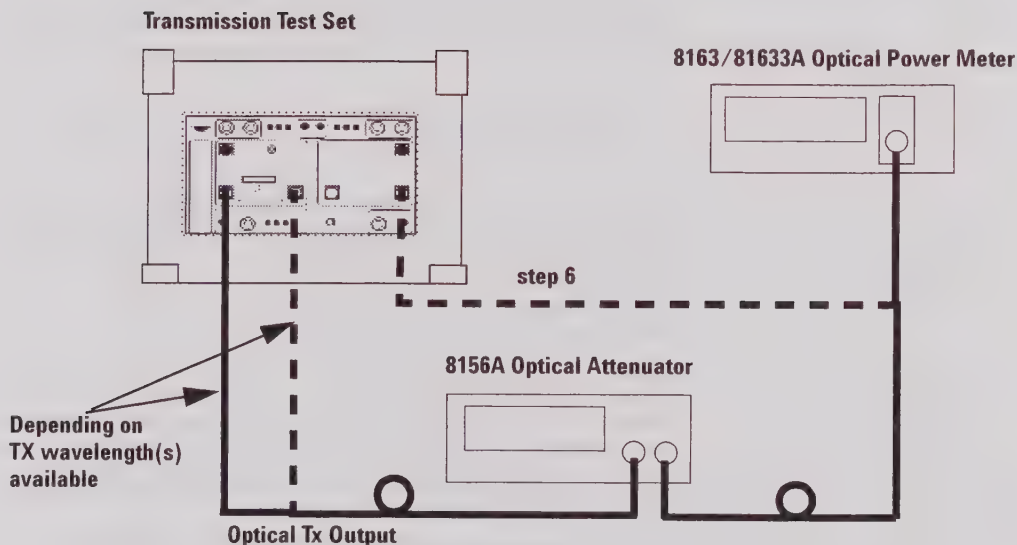
- 26** Disable the Optical Attenuator then disconnect the Optical signal from the Transmission Test Set Receiver port and connect to the Power Meter. Re-enable the Optical Attenuator.

- 27** Check the Power Meter reading is between

-8.5 and -7.5 dBm

OC-48/STM-16 Rates

- 1 Recall the Transmission Test Set default settings as shown in “Recall Default Settings” on page 59
- 2 Connect the Test Set-up as shown below, depending on wavelengths installed.



- 3 Set the Optical Attenuator to

ATTEN 15 dB

WAVELENGTH 1550nm (or 1310nm depending on wavelength used)

CAL=0

ENB ON.

Set the Optical Power Meter to

WAVELENGTH 1550nm (or 1310nm depending on wavelength used)

Connect the Optical Attenuator between the Power Meter and the Transmission Test Set's Optical Out port (ensure that all connections are tight and that the cable has no twists).

- 4 Set the Transmission Test Set Transmitter to provide OC-48/STM-16 output with PRBS bulk payload as follows.

Press <Menu> then select **Tx/Rx > Transmitter** and set **Signal Rate** to **OC48/STM-16, Wavelength 1550 nm** (or if this is not fitted select **1310 nm**). Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the selected Output Port.

- 5 Adjust the Optical Attenuator to obtain a reading of -28 dBm on the Power Meter (i.e. the Receiver minimum sensitivity for 2.5 Gb/s rate). Take note of the Attenuator setting.
- 6 Set the Optical Attenuator to Disable the mode. Note, Do not switch OFF the Transmission Test Set laser.

Disconnect the Optical Attenuator Output from the Power Meter and connect to the Transmission Test Set's Optical IN Port (2.5 Gb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the Optical Attenuator to Enable.

- 7 Set the Transmission Test Set to **TX>RX Coupled Mode**.
- 8 Press <Smart Test>, select **Shortcuts > Troublescan** then press <Run/Stop> to begin measurement.

After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected.

- 9 Increase the Optical Attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB). Press <Run/Stop> to stop measurement.

- 10** Re-set Optical Attenuator to the setting noted in step 5.
(providing -28dBm output)

Set the Transmission Test Set's Receiver to display **Optical Power**, e.g. Press <**Smart Test**> then select **Shortcuts > Optical Power**. (set **Wavelength** to 1310/1550nm as appropriate) and check that the optical power measurement reads between

- 30 and -26 dBm

Set the Transmission Test Set's Receiver to display **Frequency** and check that the frequency measurement reads between

2488.3199 and 2488.3201 MHz

- 11** Reduce the Optical Attenuator setting by a further 20 dB and check the Receiver **Optical Power** result is between

-10 and - 6 dBm

- 12** Press <**Smart Test**>, select **Shortcuts > Troublescan** then press <**Run/Stop**> to begin measurement.

After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected. Press <**Run/Stop**> to stop measurement.

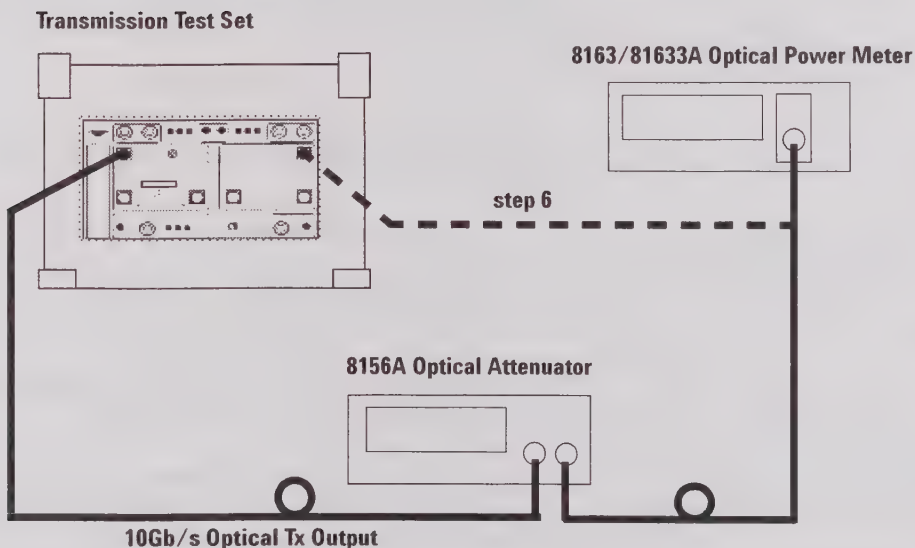
- 13** Disable the Optical Attenuator then disconnect the Optical signal from the Transmission Test Set Receiver port and connect to the Power Meter. Re-enable the Optical Attenuator.

- 14** Check the Power Meter reading is between

-8.5 and -7.5 dBm

(J2127A Models Only) OC-192/STM-64 Rate

- 1 Recall the Transmission Test Set's default settings as shown in "Recall Default Settings" on page 59
- 2 Connect the Test Set-up as shown below.



- 3 Set the Optical Attenuator to

ATTEN 15 dB
WAVELENGTH 1550nm
CAL=0
ENB ON.

Set the Optical Power Meter to

WAVELENGTH 1550nm

Connect the Optical Attenuator between the Power Meter and the Transmission Test Set's Optical Out port (ensure that all connections are tight and that the cable has no twists).

- 4 Set the Transmission Test Set Transmitter to provide OC-192/STM-64 output with PRBS bulk payload as follows.

Press **<Menu>** then select **Tx/Rx > Transmitter** and set **Signal Rate** to **OC48/STM-16**, **Wavelength** **1310 nm**. Ensure the **Laser** is set to **ON**.

Check the laser LED is illuminated at the 10 Gb/s Output Port.

- 5 Adjust the Optical Attenuator to obtain a reading of -20 dBm on the Power Meter (i.e. the Receiver minimum sensitivity for 10 Gb/s rate). Take note of the Attenuator setting.
- 6 Set the Optical Attenuator to Disable the mode. Note, Do not switch OFF the Transmission Test Set laser.

Disconnect the Optical Attenuator Output from the Power Meter and connect to the Transmission Test Set's Optical IN Port (10 Gb/s). Ensure all optical connectors are clean and all connections are tight with no twists in the optical cable. Set the Optical Attenuator to Enable.

- 7 Set the Transmission Test Set to **TX>RX Coupled Mode**.
- 8 Press **<Smart Test>**, select **Shortcuts > Troublescan** then press **<Run/Stop>** to begin measurement.

After 1 minute check that **'No Trouble'** is displayed in the Results window to confirm no errors have been detected.

- 9 Increase the Optical Attenuator setting to find the point just before the occurrence of errors by observing the Errors LED while adjusting attenuator. Record the additional attenuation setting. (typically, this will be at least 1 dB). Press **<Run/Stop>** to stop measurement.

- 10** Re-set Optical Attenuator to the setting noted in step 5.
(providing -20dBm output)

Set the Transmission Test Set's Receiver to display **Optical Power** and check that the optical power measurement reads between

- 21.5 and -18.5 dBm

Set the Transmission Test Set's Receiver to display **Frequency** and check that the frequency measurement reads between

9953.2799 and 9953.2801 MHz

- 11** Reduce the Optical Attenuator setting by a further 11 dB and check the Receiver **Optical Power** result is between

-10.5 and - 7.5 dBm.

- 12** Press <Smart Test>, select **Shortcuts > Troublescan** then press <Run/Stop> to begin measurement.

After 1 minute check that '**No Trouble**' is displayed in the Results window to confirm no errors have been detected. Press <Run/Stop> to stop measurement.

- 13** Disable the Optical Attenuator then disconnect the Optical signal from the Transmission Test Set Receiver port and connect to the Power Meter. Re-enable the Optical Attenuator.

- 14** Check the Power Meter reading is between

-9.5 and -8.5 dBm

- 15** Test complete. Set Laser to OFF before disconnecting Set-up.

Checking the Receiver Minimum Sensitivity margin versus Laser Transmitter Extinction Ratio (ER).

The Transmitter Lasers used in the tests have extinction ratio significantly better than the minimum (ER) specification. The table below gives correction factors for a range (ER) values to check the additional Receiver sensitivity measured in tests.

Using the extinction ratio results from the **Optical Pulse Mask and Output Characteristics** tests for the laser used confirm the typical 'additional' margin measured in sensitivity tests exceed values in table.

Extinction Ratio measured in Optical Pulse Mask and Output Characteristics Test	Additional Sensitivity in dB
> 8.2 dB to 9 dB	>0.4 dB
> 9 dB to 10 dB	>0.6 dB
> 10 dB to 12 dB	>0.93 dB
> 12 dB to 15 dB	>1.05 dB
> 15 dB to 20 dB	>1.2 dB

Performance Test Record

Model Agilent J2126/7A Transmission Test Set

Location

Serial No.

Tested by:

Options:

Temperature:

Certified by:

Humidity:

Date:



The test steps applicable are dependent on the instrument model and options installed. Enter N/A if a test does not apply for your instrument.

Page No.	Test Description	Min	Result Actual	Max	
Performance Self Test					
64	Step 5	Confidence Test		Pass/Fail	
64	Step 6	Frequency Measurement		Pass/Fail	
Internal Reference Clock Accuracy					
67	Step 4	2 MHz Clock OUT	2.0479908 MHz		2.0480092 MHz
69	Step 13	DS1 Clock OUT	-4.5 ppm		+4.5 ppm
70	Step 2	Alternative DS1 Test (Counter indication for framed signal)	1.540993 MHz		1.541007 MHz
External Clock Reference Inputs & Clock Reference Output					
73	Step 6	2 MHz Clock Ext	2.047999999 MHz		2.048000001 MHz
73	Step 7	Signal Locked		Pass/Fail	
74	Step 12	2 Mb/s Data Ext Unbal	2.047999999 MHz		2.048000001 MHz

Page No.	Test Description		Min	Result Actual	Max
75	Step 13	Signal Locked		Pass/Fail	
75	Step 17	2 Mb/s Data Ext Bal	2.047999999 MHz		2.048000001 MHz
75	Step 18	Signal Locked		Pass/Fail	
77	Step 22	No Alarm/Errors		Pass/Fail	
77	Step 23	DS1 Ext	1.543999		1.544001
77	Step 24	Signal Locked		Pass/Fail	

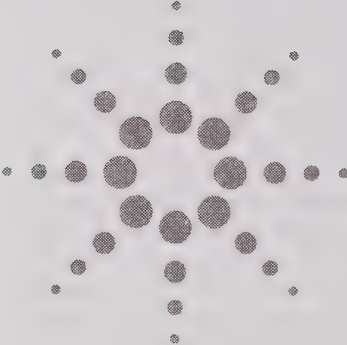
Optical Pulse Mask and Output Characteristics

Option 100/102	1310nm Optical Port (52 Mb/s- 2.5 Gb/s)				
81	Step 8	OC-1/STM-0 Mask		Pass/Fail	
81	Step 10	OC-1/STM-0 (ER)	>8.2dB		N/A
82	Step 15	OC-3/STM-1 Mask		Pass/Fail	
82	Step 17	OC-3/STM-1 (ER)	>8.2dB		N/A
83	Step 22	OC-12/STM-4 Mask		Pass/Fail	
83	Step 24	OC-12/STM-4 (ER)	>8.2dB		N/A
85	Step 31	OC-48/STM-16 Mask		Pass/Fail	
85	Step 33	OC-48/STM-16 (PWR)	-5dBm		+0dBm
85	Step 34	OC-48/STM-16 Mask	>8.2dB	Pass/Fail	N/A
Option 101/102	1550nm Optical Port (52 Mb/s- 2.5 Gb/s)				
81	Step 8	OC-1/STM-0 Mask		Pass/Fail	
81	Step 10	OC-1/STM-0 (ER)	>8.2dB		N/A
82	Step 15	OC-3/STM-1 Mask		Pass/Fail	
82	Step 17	OC-3/STM-1 (ER)	>8.2dB		N/A

Page No.	Test Description		Min	Result Actual	Max
83	Step 22	OC-12/STM-4 Mask		Pass/Fail	
83	Step 24	OC-12/STM-4 (ER)	>8.2dB		N/A
85	Step 31	OC-48/STM-16 Mask		Pass/Fail	
85	Step 33	OC-48/STM-16 (PWR)	-2dBm		+3dBm
85	Step 34	OC-48/STM-16 Mask	>8.2dB	Pass/Fail	N/A
Option 111	1550nm Optical Port (10Gb/s)				
87	Step 8	OC-192/STM-64 Mask		Pass/Fail	
87	Step 8	OC-192/STM-64 (PWR)	-1dBm		+1dBm
88	Step 11	OC-192/STM-64 (ER)	>8.2dB	Pass/Fail	
Optical Receiver Sensitivity, Optical Power & Frequency Measurement					
	Optical Receive Port (52 & 155 Mb/s)				
92	Step 4	Laser LED ON		Pass/Fail	
93	Step 5	Note Attenuator Set	N/A		N/A
94	Step 9	'No Trouble' Min Sens		Pass/Fail	
94	Step 10	Additional Attenuation	Typ > 1dB		N/A
95	Step 11	-30dBm PWR meas	-31dBm		-29dBm
95	Step 11	OC-1/STM-0 Frequency	51.83999MHz		51.84001MHz
96	Step 12	-10dBm PWR meas	-11dBm		-9dBm
96	Step 13	'No Trouble' Max Sens		Pass/Fail	
96	Step 15	Power Meter check	-10.5		-9.5
92	Step 4	Laser LED ON		Pass/Fail	

Page No.	Test Description		Min	Result Actual	Max
93	Step 5	Note Attenuator Set	N/A		N/A
94	Step 9	'No Trouble' Min Sens		Pass/Fail	
94	Step 10	Additional Attenuation	Typ > 1dB		N/A
95	Step 11	-30dBm PWR meas	-31dBm		-29dBm
95	Step 11	OC-3 /STM-1 Frequency	155.51999MHz		155.52001MHz
96	Step 12	-10dBm PWR meas	-11dBm		-9dBm
96	Step 13	'No Trouble' Max Sens		Pass/Fail	
96	Step 15	Power Meter check	-10.5		-9.5
Optical Receive Port (622 Mb/s)					
97	Step 17	Laser LED ON		Pass/Fail	
97	Step 18	Note Attenuator Set	N/A		N/A
97	Step 21	'No Trouble' Min Sens		Pass/Fail	
97	Step 22	Additional Attenuation	Typ > 1dB		N/A
98	Step 23	-28dBm PWR meas	-29dBm		-27dBm
98	Step 23	OC-12/STM-4 Frequency	622.07999MHz		622.08001MHz
98	Step 24	-8dBm PWR meas	-9dBm		-7dBm
98	Step 25	'No Trouble' Max Sens		Pass/Fail	
98	Step 26	Power Meter check	-8.5		-7.5
Optical Receive Port (2.5Gb/s)					
100	Step 4	Laser LED ON		Pass/Fail	
100	Step 5	Note Attenuator Set	N/A		N/A

Page No.	Test Description		Min	Result Actual	Max
100	Step 8	'No Trouble' Min Sens		Pass/Fail	
100	Step 9	Additional Attenuation	Typ > 1dB		N/A
100	Step 10	-28dBm PWR meas	-30dBm		-26dBm
100	Step 10	OC-48/STM-16 Frequency	2488.3199MHz		2488.3201MHz
101	Step 11	-8dBm PWR meas	-10dBm		-6dBm
101	Step 12	'No Trouble' Max Sens		Pass/Fail	
101	Step 13	Power Meter check	-8.5		-7.5
	Optical Receive Port (10Gb/s)				
104	Step 4	Laser LED ON		Pass/Fail	
104	Step 5	Note Attenuator Set	N/A		N/A
104	Step 8	'No Trouble' Min Sens		Pass/Fail	
104	Step 9	Additional Attenuation	Typ > 1dB		N/A
104	Step 10	-20dBm PWR meas	-21.5dBm		-18.5dBm
104	Step 10	OC-192/STM-64 Frequency	9953.2799MHz		9953.2801MHz
104	Step 11	-9dBm PWR meas	-10.5dBm		-7.5dBm
104	Step 12	'No Trouble' Max Sens		Pass/Fail	
104	Step 14	Power Meter check	-9.5		-8.5
105	Check Receiver Sensitivity margin v.s. Transmitter Extinction Ratio			Pass/Fail	



4

Self Test Overview

Description of the Self Test	112
List of Self Tests	113
Loopback connections required for Self Test	114
How to run a Self Test	117
What to do if the Self Test Fails	121

The instrument Self Test consists of a number of tests and sub-tests designed to verify the functionality of the instrument measurement and utility ports as well verify the major hardware paths within the instrument.

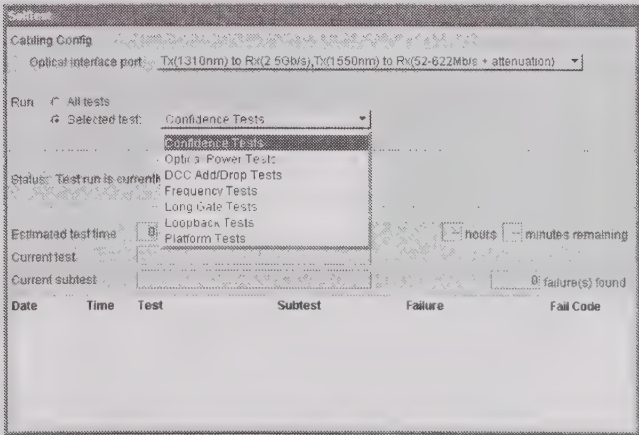
This section gives an overview of the instrument Self Tests available on the instrument.



Description of the Self Test

The Self Test comprises of several tests each consisting of a number of sub tests (the tests available and number of sub tests within each test is model and option dependent). Self Test can be run as one complete sequence or an individual test may be run. If a failure occurs then a descriptive text message and Fail Code is returned. Error example is provided at the end of this section.

The Self Test is selected by pressing the <Menu> key then selecting **System > Self Test**. An example of the Self Test page in Selected Test mode with is shown below.



List of Self Tests

The Self Test comprises of several tests. Each test consists of a number of sub tests. A brief description of each test is given below.

TEST 1 - Platform Test

This performs basic test of the CPU memory and IDE interface.

TEST 2 - Confidence Test

This test checks the optical and the electrical paths. A basic signal continuity check is performed. This involves verifying the the signal configuration by injecting/detecting a single error.

TEST 3 - Optical Power Test

This test checks both the data paths and the optical power measurement circuitry.

TEST 4 - DCC Add/drop Test

The test checks the data paths associated with the DCC add/drop hardware. The DCC loopback should be fitted for this test.

TEST 7 - Frequency Test

This test checks the data path through the clock offset and frequency measurement hardware. The test checks the absolute clock offset frequency result.

TEST 9 - Long Gate Test

The test verifies error free operation ($BER < 1.0E-12$) at all optical line rates.

TEST 11 - Loopback Test

Performs the Confidence Test with internal loopbacks enabled. Note this test is bypassed except in Factory test mode.

The Self Test can be run in one of two modes **Run > All Tests** or **Run > Selected Test**.

Tests 5, 6, 8 and 10 are not currently applicable.

Loopback connections required for Self Test

The Self Tests loopbacks required for each test are listed below. Those required are dependent on the Model/Option and Test selected. See diagram below indicating loopback connections for a J2127A with option 102. Table indicates the minimum test loopback requirements.

Optical Loopback Connections (dependent on instrument Model and Wavelength options fitted)

- Use optical cables P/N 1005-0337 and 15dB attenuator P/N 1005-0433

(J2127A Only) Connect 10Gb/s 1550nm Optical Out <> 15dB Attenuator <> 10Gb/s Optical In

Connect 52Mb/s-2.5Gb/s Optical Out <> 15dB Attenuator <> 2.5Gb/s Optical In

Connect 52Mb/s-2.5Gb/s Optical Out <> 15 dB Attenuator <> 52Mb/s-622Mb/s Optical In

Electrical connections 155Mb/s to 8Mb/s (only instruments with J2129A Enhanced FW installed)

- Use BNC cables P/N 15525A

Connect 52/155Mb/s Out (BNC) <> 52/155Mb/s In (BNC)

Connect 2-140Mb/s DS3 Out (BNC) <> 2-140Mb/s DS3 In (BNC)

Balanced electrical connections 2M/DS1 (instruments with J2129A only)

- Use 3-pin Siemens cable P/N 15512A and Bantam cable P/N 15670A

Connect 2M Out (3-pin Siemens) <> 2M In

Connect DS1 Out <> DS1 In

DCC Loopback connector (only required if DCC ADD/DROP TEST or All tests are selected)

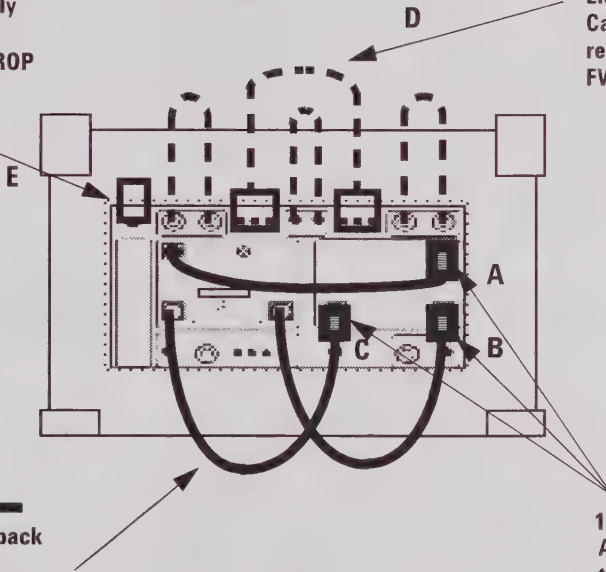
Connect DCC loopback plug to 9-pin DCC port P/N J2125-65011

DCC Loopback connector only required for DCC ADD/DROP or (All Tests)

Electrical Loopback Cabling is only required if J2129A FW is fitted.

Optical Loopback Patch Cords Shown for option 102, 111 instrument

15dB Optical Attenuators to ensure level is within Receiver Input Range



Loopback connections for a J2127A with option 102



Safety precautions care and connection cleanliness must be observed to ensure that the optical connections are not damaged or degraded. Ensure the recommended optical attenuation is present in all optical loopback connections as failure to do so could cause self test failure or damage to the optical receivers.

Self Test	Optical Loopback (15dB Attenuation must be used) loopbacks used are dependent on Model/Option	Electrical Loopback only required if J2129A FW is installed.	DCC Loopback plug
• All	A,B,C	D	E
• Confidence Test	A,B,C	D	not required
• Optical Power Test	A,B,C	not required	not required
• DCC Add/Drop Test	A/B	not required	E
• Frequency Test	A,B,C	D	not required
• Long Gate Test	A,B,C	not required	not required
• Loopback Test	not required	not required	not required
• Platform Test	not required	not required	not required

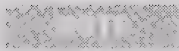
Minimum test loopback requirements



If single wavelength optics are fitted to the 2.5Gb/s - 52Mb/s Optical Out port then the Self Test should be performed twice to verify all the Optical In ports. Perform the test with the 2.5Gb/s-52Mb/s Optical Out port connected to the 2.5Gb/s Optical In port and repeat with the 2.5Gb/s-52Mb/s Optical Out port connected to the 662-52Mb/s Optical In port. Select the cable configuration from the test menu as appropriate.

How to run a Self Test

- 1 The Self Test is selected by pressing the <Menu> key and selecting **System > Self Test**.
- 2 Ensure all loopbacks are in place and from the Self Test page menu select the appropriate 1310/1550nm 2.5G - 52M optical loopback Cabling Configuration. Loopback accordingly taking care to ensure attenuation is provided in the Optical loopback paths.
- 3 On the Self Test page choose **Run Selected Test** and choose the selected test. Choose **START** to begin the test.

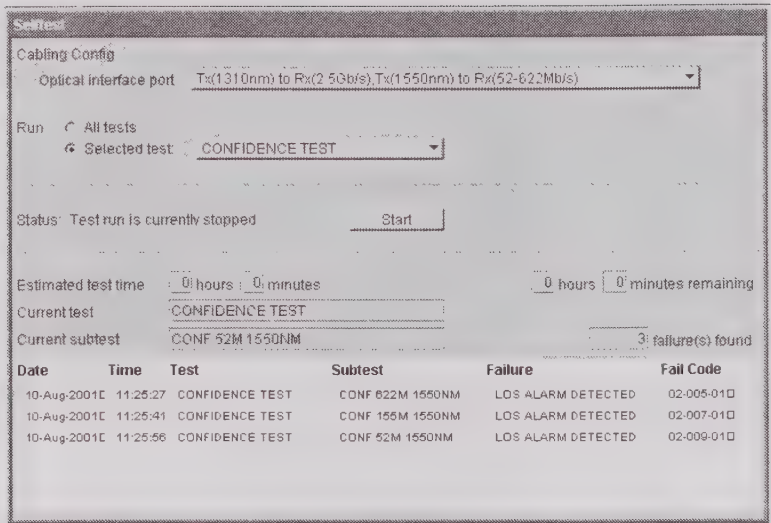


The Long Gating test takes several hours to run as it tests all Optical rates for error ratio less than 1 in 10^{-12} . The estimated run time for selected Test is displayed on the Self Test Page.

- 4 The Self Test will now run, selecting each sub-test in sequence. The elapsed test time and remaining test time is displayed.
- 5 If any sub-test fails a error message and error code will be returned. Up to five sub-test errors can be logged before the test ends/aborts.
- 6 End of procedure.

Error messages and codes

The approximate test time for selected test is shown on the Self Test display. Most tests except the 'Long Gating' test take 1-2 minutes to complete. If no errors are recorded then all sub tests have passed. If any subtest fails, an error message is returned along with an error code which returns Test Number, Sub Test Number. An example of a test failure is shown below.



List of Self Test sub tests

A list of all the possible sub tests in any given Test is shown below. Each interface is tested in sequence starting with the highest rate interface down to the lowest rate interface. The actual number of sub tests run is dependent on the instrument model and option structure, for example J2127A / J2126A, single or dual wavelength.

TEST 1 - Platform Test

This performs basic test of the CPU memory and IDE interface.

TEST 2 - Confidence Test

<u>Subtest Number</u>	<u>Sub Test Description</u>
1	CONF 10G 1550NM
2	CONF 2G5 1310NM
3	CONF 2G5 1550NM
4	CONF 622M 1310NM
5	CONF 622M 1550NM

6	CONF 155M 1310NM
7	CONF 155M 1550NM
8	CONF 52M 1310NM
9	CONF 52M 1550NM
10	CONF 155M
11	CONF 52M
12	CONF E4 UNBAL
13	CONF E3 UNBAL
14	CONF E2 UNBAL
15	CONF E1 BAL
16	CONF E1 UNBAL
17	CONF DS3 UNBAL
18	CONF DS1BAL

TEST 3 - Optical Power Test

<u>Subtest Number</u>	<u>Sub Test Description</u>
1	10G 1550nm
2	2.5G 1310/1550nm
3	622M 1310/1550nm

TEST 4 - DCC Add/Drop Test

<u>Subtest Number</u>	<u>Sub Test Description</u>
1	Performed at maximum available interface rate

TEST 7 - Frequency Measurement

<u>Subtest Number</u>	<u>Sub Test Description</u>
1	10G-52M rates
2	E4
3	E1

TEST 9 - Long Gating Test

<u>Subtest Number</u>	<u>Sub Test Description</u>
1	10G
2	2.5G
3	622M
4	155M
5	52M

TEST 11 - Loopback Test

Performs the Confidence Test (Test 2) with internal loopbacks enabled.

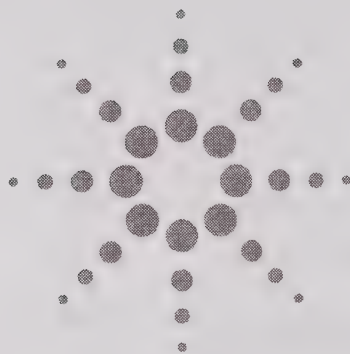
Note this test is bypassed except in Factory test mode.

What to do if the Self Test Fails

- 1 Check all connections to make sure that all the correct loopback connections are in place and Optical Attenuators are fitted as required.
- 2 Be suspicious of any optical interface failures and if necessary clean all optical connections with a recognized cleaning kit before retrying the Self Test.
- 3 If the problem persists then contact your local Agilent Service Office or representative.

Tips and Checks to Confirm Correct Optical Loopback

- Make sure connectors are located in key/notch of the port connectors to ensure full insertion.
- Check Transmitter and Receiver are set to the same Signal Rate and that the correct Laser is On when test is being Run.
- Press <Smart Test> then select **Shortcuts > Signal Power** and check the Received signal level is in the Green BER measurement power range.
- Ensure all optical connections are clean and fully connected with no sharp bends or twists in the optical patch cord. Check the Optical Cord and Attenuator are not damaged and/or substitute with equivalent



5 ETSI/ANSI Terminology

The terminology used on the instrument display can be ETSI (SDH) or ANSI (SONET). Refer to the table given in this section for an explanation of equivalent SDH/SONET terms.



ETSI/ANSI Conversion and Equivalent Terms

ETSI: European Telecommunications Standards Institute.

ANSI: American National Standards Institute.

ETSI (SDH) Term	ANSI (SONET) Term
AU-3	STS-1 SPE + H1, H2, H3
AU-4	STS-3c SPE + H1, H2, H3
BIP (Bit Interleaved parity)	CV (Code Violation)
High Order Path (HP / H0)	STS Path
I-n Intra Office, (n=STM-n level)	Intermediate Reach (IR)
L-n.1 or L-n.2 long haul	LR long reach
Low Order Path (LP / L0)	VT Path
LP-REI	REI-V
M.S.P	A.P.S
Multiplexer Section (MS)	Line
Multiplexer Section Protection	Automatic Protection Switching
MS-AIS	Line AIS / AIS-L
MS-BIP	Line CV / CV-L
MS-DCC	Line DCC / DCC-L
MS-REI	Line FEBE / REI-L
MS-RDI	Line FERF / RDI-L
Multiplexer Section Overhead	Line Overhead
Network Node Interface	Line Interface
OOF	SEF (severely errored frame defect)
Path AIS / AU-AIS	AIS-P
Path REI / HP REI	REI-P
Path FERF / HP RDI	RDI-P

ETSI (SDH) Term	ANSI (SONET) Term
Path IEC / AU-IEC	IEC-P
Path Overhead	Path Overhead
Regenerator	Repeater
Regenerator Section (RS)	Section
Regenerator Section Overhead	Section Overhead
Remote Alarm Indicator	RAI
RS-DCC	Section DCC (DCC-S)
Section Overhead (SOH)	Transport Overhead (TOH)
S-n.1 or S-n.2 short haul	Short Reach (SR)
SOH	TOH
STM-m	OC-n / STS-n (where $m = n + 3$ for $m \geq 1$)
STM-0	STS-1
STM-1	OC3c / STS-3c
STM-4	OC-12 / STS-12
STM-16	OC-48 / STS-48
STM-64	OC-192
Tributary Unit (TU)	Virtual Tributary (VT)
TU	VT
TU-11	VT 1.5
TU-12	VT 2
TU-2	VT 6
TU-3	NONE
TU BIP	VT BIP (CV-V)
TU RDI / LP-RDI	RDI-V
TUG	VT Group
TUG2	VT Group (12 columns)

ETSI (SDH) Term	ANSI (SONET) Term
TUG3	VT Group (86 columns)
TU multiframe	VT superframe
TU PATH AIS	VT AIS (AIS-V)
VC	SPE
VC4	STS3C SPE
Virtual Container (VC)	Synchronous Payload Envelope (SPE)

NOTE: VC is an ETSI abbreviation for Virtual Container and an ETSI / ANSI abbreviation for (ATM) Virtual Channel. The context of VC must therefore be taken into account when converting between standards.

Index

Numerics

- 10 Base-T LAN Connection Radiated Emissions, 51
- 10 Gb/s Optical In port, 46
- 10 Gb/s Optical Out port, 45
- 10 Gb/s Optical Output Checks (J2127A Models only), 86
- 2 Mb/s 2 MHz Clock In, 46
- 2 Mb/s In port, 48
- 2 Mb/s Out port, 48
- 2 MHz Clock Out port, 46
- 2.5 Gb/s Optical In port, 45
- 2-140 Mb/s DS3 In port, 49
- 2-140 Mb/s DS3 Out port, 49
- 52 - 622 Mb/s Optical In port, 45
- 52 Mb/s - 2.5 Gb/s port, 44
- 52/155 & 622 Mb/s Optical Output Checks, 79

A

- Accessories, 14
- Additional documentation, 14
- Altitude, 19
 - environment, 28
- Assistance, 17

B

- Back to Back Functional checks, 35

C

- Calibration Cycle, 56
- Carrying cases, 14
- Certificate of Calibration, 13
- Certification, 17
- Changing the Network Standard Setting, 34
- Cleaning Optical Connectors, 23
- Clock Offset/frequency Measurement Sub Test, 119

- Clock Ports, 46
- Compliance, 25
- Confidence Sub Test, 118
- Confidence Test, 60, 113
- Connecting optical cables, 41
- Connecting to the Network, 40
- Connectors, 44
- Cover - how to remove, 31
- CPU Test, 113

D

- DCC, 47
- DCC Add/Drop Sub Test, 119
- DCC Add/Drop Test, 113
- Declaration of Conformity, 26
- Default Settings, Recall of, 59
- Disconnecting optical cables, 41
- DS1
 - Clock Input, 46
 - Clock Out port, 46
- DS1 Clock test
 - Alternative, 70
- DS1 In port, 49
- DS1 Out port, 50

E

- Electrical Test Ports, 48
- Electromagnetic Compatibility, 26
- Enhanced Testing, 13
- External Clock Reference Inputs & Clock Reference Output, 71

F

- Frequency Measurement Self Test, 113
- Frequency Measurement Test, 60
- Front Panel Soft Recovery (Cold Start), 53
- fuses, 29

G

- General Information, 15
- GPIO port, 50

H

- How to
 - remove instrument cover, 31
 - run the Self Test, 117
- Humidity, 29

I

- Initial Inspection, 28
- Installation, 27
- Instrument Cover - How to remove, 31
- Instruments Covered By Manual, 18
- Internal Reference Clock Accuracy, 65
 - Equipment Required, 66
 - Procedure, 66

J

- J7280A, 14
- J7281A, DCC port converter cable, 14
- J7282A, soft carrying case (J2126/7A), 14
- J7283A, FC/PC optical connector, 14
- J7284A, SC optical connector, 14
- J7285A, ST optical connector, 14
- J7286A, hard transit case (J2126A), 14
- J7287A, hard transit case (J2127A), 14

K

- Keyboard connector, 51

L

- LAN 10M/100M Base-T port, 51
- Laser Product Classification, 40
- Laser Warning Symbols, 41
- Line frequency measurement, 90
- Long Gate Test, 113
- Long Gating Sub Test, 120
- Loopback connections required for Self Test, 61, 114
- Loopback Test, 113
- Loss of Signal/Alarm Sub Test, 118

M

Mainframe test rate capability, 12
Mouse - PS/2 port, 51

N

Network Standard Setting, Changing
the, 34
Noise Declaration, 26

O

OC-1/STM-0 Power Level & Eye Mask
Tests, 79
OC-12/STM-4 Power Level & Eye Mask
Tests, 83
OC-192/STM-64 Power Level & Eye Mask
Tests, 86
OC-3/STM-1 Power Level & Eye Mask
Tests, 82
OC-48/STM-16 Power Level & Eye Mask
Tests, 84
Operating Environment, 28
Operators Maintenance, 23
Optical Adapters and Cables, 14
Optical Connectors, 45
Optical connectors
cleaning, 23
Optical In Ports, 45
Optical Interface Connectors, 40
Optical Interfaces, 12
Optical Loopback-Tips and Checks, 121
Optical Out Ports, 44
Optical Patch Cord, 35
Optical power measurement, 90
Optical Power Measurement Sub Test, 119
Optical Power Test, 113
Optical Pulse Mask and Output
Characteristics, 78
Optical Receiver Sensitivity, Optical Power &
Frequency Measurement, 89
OC-1/STM-0 and OC-3/STM-1
Rates, 91
OC-12/STM-4 Rate, 97
OC-192/STM-64 Rate (J2127A Models
Only), 102
OC-48/STM-16 Rates, 99
Option Guide, 12

Option UK6, 13
Option W30, 13
Option W50, 13
Original Packaging, 19
Other Options, 13

P

Packaging, 19
Performance Self Test
What to do if it fails, 64
Performance Test Record, 106
Performance Tests - Recommended Test
Equipment, 57
Power Cable, 30
Power Requirements, 29
Power-up Sequence, 33
Precautions for Service Engineers, 43
Preparation for Use, 29
Product Description, 10

R

Recall Default Settings, 59
Recommended Test Equipment,
Performance Tests, 57
Removing the Instrument Cover, 31
Repackaging for Shipment, 19
Requesting support, 32
Responsibilities of the Customer, 17
RS232 port, 51

S

Safety Precautions, 43
Safety Precautions for the Operator, 21
Self Test, 60
CONFIDENCE TEST, 113
CPU TEST, 113
DCC ADD/DROP TEST, 113
FREQ MEAS, 113
How to run, 64, 117
LONG GATE TEST, 113
Loopback Connections, 114
LOOPBACK TEST, 113
OPTICAL POWER TEST, 113
sub tests, 118
What to do if it fails, 121

Self Test Loopback Cables and
Accessories, 58
Self Test, Description of, 112
Serial Number Plate, 18
Service plans, 13
Shipping/Transit to Customer Sites, 19
SONET/SDH In port, 48
SONET/SDH Out port, 48
Specifications, 89
Statement of Compliance, 25
Storage and Shipment, 19
Sub Test
CLOCK OFFSET/FREQUENCY
MEASUREMENT, 119
DCC ADD/DROP TEST, 119
LONG GATING TEST, 120
LOSS OF SIGNAL/ALARM TEST, 118
OPTICAL POWER
MEASUREMENT, 119
Sub Tests
CONFIDENCE TEST, 118

T

Temperature, 19
environment, 28, 29
Tips and Checks to Confirm Correct Optical
Loopback, 121
Transit Cases, 19
TX Eye Clock 10 Gb/s, 47
TX Eye Clock 52 - 2.5 Mb/s, 47

U

USB port, 51

V

Ventilation Requirements, 29
VGA port, 52

W

Warranty, 13, 15
What to do if the Self Test fails, 121

In this book

This book contains all the information you need to be able to verify the correct performance and installation of the Transmission Test Sets. It is aimed at both new and experienced users.

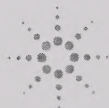


Printed in U.S.A

Manual Part Number
J2127-90002



J 2 1 2 7 - 9 0 0 0 2



Agilent Technologies